BLM LIBRARY
88051317

Bureau of Land Management
California

Rockshelter Excavations on Hogback Ridge, Tehama County, California: The Archaeological Record

By

Eric W. Ritter
and
KD Tyree

cultural resources publications
archaeology

E
78
.C15
R578
1999

QL

E
79
.C15
R57
1999

Rockshelter Excavations on Hogback Ridge, Tehama County, California: The Archaeological Record

Eric W. Ritter
and
KD Tyree

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225

Bureau of Land Management
Redding Field Office
355 Hemsted Drive
Redding, California 96002-0910

1999

ABSTRACT

Limited test excavations at three small rockshelters on Hogback Ridge in Tehama County near Red Bluff were geared toward two goals: (1) significance evaluation prior to a federal land exchange decision, and (2) increasing our knowledge regarding past prehistoric inhabitants of the southern Cascade foothills.

Overall the three shelters, while providing some interesting information regarding aspects of late prehistoric lifeways, generally lack complexity and substantial information potential and do not appear to be eligible for listing on the National Register of Historic Places. The shelters appear to have formed the base for seasonal (probably at least fall and spring to early summer), periodic small family group residency related to a more sweeping dispersed seasonally variable foraging/collecting pattern in the region. Such a broadly scattered system of mobility and subsistence is hypothesized to be the result of societal crises, especially in the realm of food and nutrition, brought about by unknown agents. Dispersed seasonal subsistence/camp life would logically result in a more dependable harvest of fixed and non-fixed food resources found scattered among numerous environmental patches often closely juxtaposed. This resource intensification process was one of probably a number of measures that were tried to alleviate tendencies toward cultural instability.

ACKNOWLEDGMENTS

Appreciation is extended to a number of individuals who helped along the way in this small project. Assistance in excavation was offered by Larry Cox, Chris Parker, Elaine Sundahl and Adam Bodine, the latter who also provided his artistic talents to some of the figures.

A small cadre of scholars provided their expert service in completing various special studies. Included in this list are Dr. John Fagan for his blood residue analysis, Blossom Hamusek for obsidian sourcing, Dr. Michael Kolb for soils/sediment work, Lisa Swillinger for obsidian hydration examination, Nancy Valente for identifying faunal remains, Dr. James West for pollen investigation, and Eric Wohlgemuth for seed examination.

We appreciate the input from Wintu/Yana coordinator Barbara Murphy of the Redding Rancheria and the word processing skills of Marka Gibson. Discrepancies, mistakes, omissions and faults with this overall product rest with the authors. In a modest manner we hope this contribution will advance our knowledge of these past peoples.

TABLE OF CONTENTS

	Page
Abstract	i
Acknowledgments	ii
Table of Contents	iii
List of Figures	v
List of Tables	vi
Introduction	1
Local Environment	1
Archaeological Background	5
Ethnographic Background	6
Geoarchaeology	7
Excavation Strategy	9
Features	16
Faunal Remains	16
Floristic Remains	17
Human Burial	17
Ground Stone Artifacts	18
Metates	18
Mano	24
Fire Cracked or Affected Rock	24
Flaked Stone Artifacts	26
Methodology	27
CA-TEH-1554 (B&B Rockshelter)	29
Debitage	29
Site Lithic Summary	31
CA-TEH-1555 (Blue Dick Rockshelter)	31
Debitage	31
Cores	33
Site Lithic Summary	34
CA-TEH-1556 (Pipevine Rockshelter)	34
Debitage	35
Cores	37
Retouched Tools	40
Edge-Modified Piece	40
Uniface	42
Projectile Point	42
Site Lithic Summary	42
Site Comparisons for Flaked Stone	43
Obsidian Studies	44
Blood Residue Analysis	44
Conclusions	44
Chronology	44

TABLE OF CONTENTS (con't.)

Conclusions (con't.)
- Settlement-Subsistence 45
- Technological Considerations 46
- Trade Exchange 46
- Site Formation/Transformation Processes 46
- General Discussion 46

References Cited 48

Appendix 1
Research Design for Archaeological Investigation within the Foothill Region of the Southern Cascades with Emphasis on Limited Testing of B&B Rockshelter (CA-TEH-1554), Blue Dick Rockshelter (CA-TEH-1555), and Pipevine Rockshelter (CA-TEH-1556) by Eric W. Ritter, Ph.D. 55

Appendix 2
Report of Radiocarbon Dating Analysis by Murry Tamers, Ph.D. of Beta Analytic, Inc. 65

Appendix 3
Archaeofaunal Remains from CA-TEH-1556, CA-TEH-1555, and CA-TEH-1554, Tehama County, California by Nancy Valente 68

Appendix 4
Charred Plant Macrofossils from TEH-1555 and TEH-1556 by Eric Wohlgemuth 83

Appendix 5
Artifact Classification (Morphology), Definitional Criteria, and Lithic Terminology 90

Appendix 6
Raw Data Generated for Identifiable and Unidentifiable Debitage 95

Appendix 7
X-ray Fluorescence (XRF) Analysis by Blossom Hamusek of California State University, Chico, Department of Anthropology 107

Appendix 8
Hydration Band Measurements by Lisa Swillinger of California State University, Chico, Department of Anthropology 112

Appendix 9
Blood Residue Analysis by John L. Fagan, Ph.D. of Archaeological Investigations Northwest 116

LIST OF FIGURES

		Page
Frontispiece: View of Antelope Canyon westerly from Pipevine Rockshelter		
Fig. 1	Location Map of Rockshelters	2
Fig. 2	Photographs at Rockshelter Excavations Blue Dick Rockshelter (CA-TEH-1555)	3
Fig. 3	Photographs at Pipevine Rockshelter (CA-TEH-1556) and B& B Rockshelter (CA-THE-1554)	4
Fig. 4	Plan Drawing of CA-TEH-1554 (B&B Rockshelter) with excavation unit locations	10
Fig. 5	Lateral Cross-section of CA-TEH-1554 (B&B Rockshelter)	11
Fig. 6	Plan Drawing of CA-TEH-1555 (Blue Dick Rockshelter) with excavation unit locations	12
Fig. 7	Lateral Cross-section of CA-TEH-1555 (Blue Dick Rockshelter)	13
Fig. 8	Plan Drawing of CA-TEH-1556 (Pipevine Rockshelter) with excavation unit locations	14
Fig. 9	Lateral Cross-section of CA-TEH-1556 (Pipevine Rockshelter)	15
Fig. 10	Metate (455-22) from CA-TEH-1554 (B&B Rockshelter)	19
Fig. 11	Metates (454-1, -2) from CA-TEH-1555 (Blue Dick Rockshelter)	20
Fig. 12	Metates (473-60, -64) from CA-TEH-1556 (Pipevine Rockshelter)	21
Fig. 13	Metate (473-61) from CA-TEH-1556 (Pipevine Rockshelter)	22
Fig. 14	Metates (473-62, -63) from CA-TEH-1556 (Pipevine Rockshelter)	23
Fig. 15	Schematic of Methodology	28
Fig. 16	Multiple Platform Cores (473-2, -4, -6) from CA-TEH-1556 (Pipevine Rockshelter)	38
Fig. 17	Multiple Platform Cores (473-7, -9, -53) from CA-TEH-1556 (Pipevine Rockshelter)	39
Fig. 18	Uniface (473-40), Projectile Point (473-10), and Edge-Modified Piece (473-8) from CA-TEH-1556 (Pipevine Rockshelter)	41
Fig. 19	Feature 2 (ash lens and cairn) from Unit B, CA-TEH-1556	54

LIST OF TABLES

		Page
Table 1	Soil Sediment Properties	7
Table 2	Milling Tool Characteristics	24
Table 3	Distribution of Fire Cracked and Affected Rock	25
Table 4	Applied Attributes for the Flaked Stone Assemblage	29
Table 5	CA-TEH-1554: Flaked Stone Artifacts By Raw Material	29
Table 6	CA-TEH-1554: Identifiable Debitage Frequencies By Raw Material and Type	30
Table 7	CA-TEH-1555: Flaked Stone Artifacts By Raw Material	31
Table 8	CA-TEH-1555: Identifiable Debitage Frequencies By Raw Material and Type	32
Table 9	CA-TEH-1555: Selected Core Attributes	33
Table 10	CA-TEH-1556: Flaked Stone Artifacts By Raw Material	34
Table 11	CA-TEH-1556: Identifiable Debitage Frequencies By Raw Material and Type	35
Table 12	CA-TEH-1556: Identifiable Debitage By Raw Material, Unit and Level	36
Table 13	CA-TEH-1556: Selected Core Attributes	37

INTRODUCTION

Among the greatest challenges facing archaeologists in land managing situations in California and elsewhere in the United States as we move into the 21st century is in assessing the significance of archaeological sites. Such evaluations must be done in terms of a set of often ambiguous legal criteria formulated into regulation. National-level guidance and the development of regional research designs or plans conducive to an idea-generating scientific approach help in these situations, especially where a site's research potential or ability to answer meaningful questions towards understanding past human behavior and culture are concerned, the crux of "modern archaeology" as discussed by Earle and Preucel (1987) and Redman (1991). This ability is made even more difficult when subsurface deposits are known or suspected and where the site is small in size or exhibits little outward complexity.

This challenge was presented to the authors when three small nearby rockshelters (Figures 1, 2, and 3) were discovered in 1991 in central Tehama County on lands that the Bureau of Land Management proposed for exchange with private parties. Two of the shelters are on the north side of Antelope Creek: Blue Dick (CA-TEH-1555) and Pipevine (CA-TEH-1556). The third shelter, CA-TEH-1554, the B&B Rockshelter, is located along the southerly rim rock of adjoining Salt Creek Canyon just across Hogback Ridge.

These rockshelter excavations were not the first to be undertaken by the senior author in this southern Cascade foothill canyon region. Previous excavations at CA-TEH-1432 (Spider Rockshelter), a very similar site, were undertaken in 1985 utilizing a regional research design developed for the project (Ritter 1987: Appendix 1). This research design was found relevant in many aspects to the project described herein. In addition, a more recent independent research design was developed for nearby excavation at the New Creek Site (CA-TEH-1488) located on the Valley edge only six kilometers away (Nilsson, Flint, and Greenway 1991). Based on these two research designs, the design formulated for this investigation was based on the initial field assessment of the sites and their archaeological potential (Appendix 1).

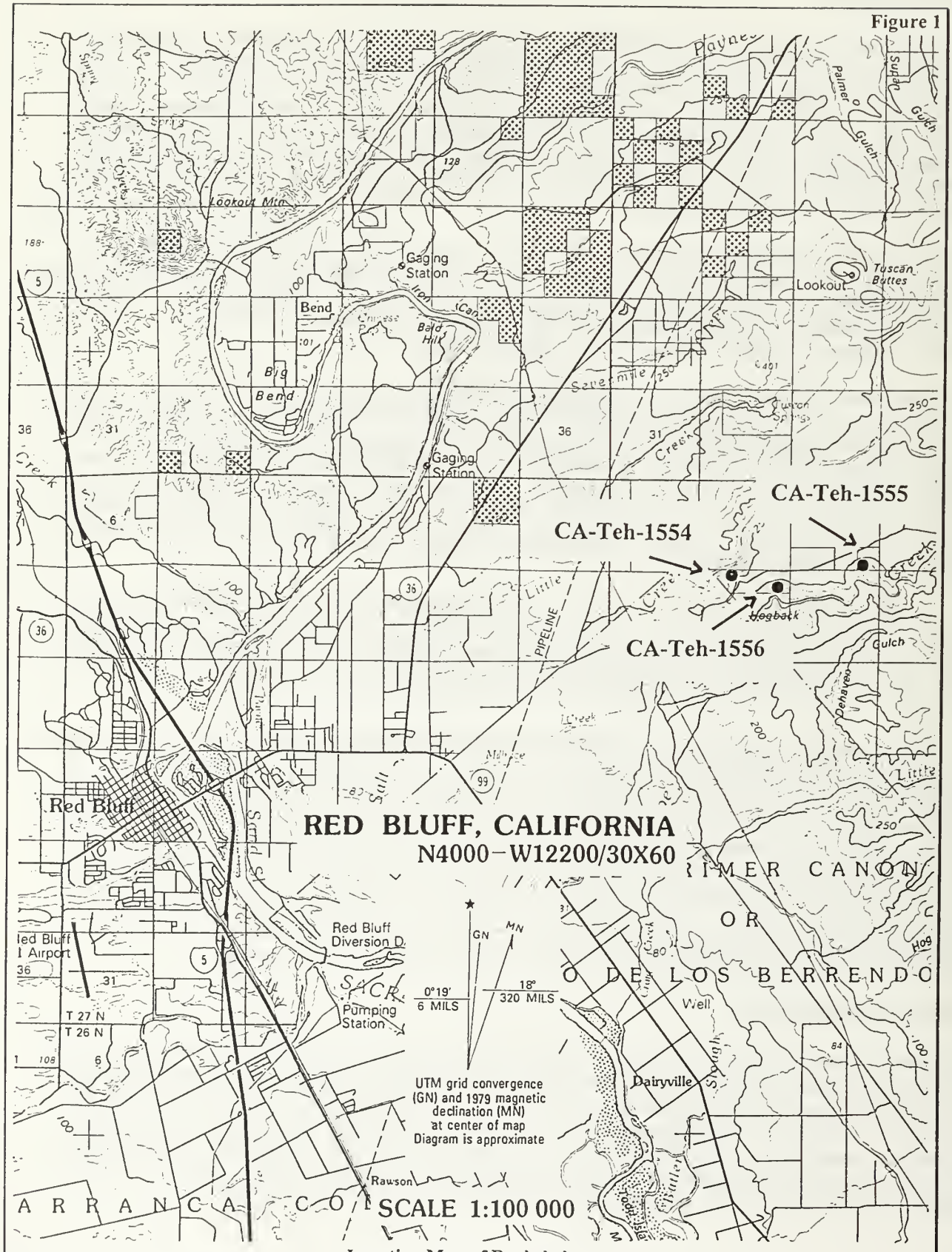
The significance evaluation of these sites through testing is a precursor to a number of potential management options, including further testing for evaluation, retention, or disposal. Coordination with the State Historic Preservation Officer of the State Office of Historic Preservation regarding the sites' potential value (or absence of value) and the senior author's opinion will influence BLM's management decision. This report is the keystone to that process.

This report and the archaeological work leading up to its finalization is approached in a traditional fashion with a discussion of data including artifacts by general class and type, and individual discussion on features, the inhumations, flora and faunal remains, site soils and sediments, fire cracked rock, pollen analysis, lithic analysis, obsidian studies, and dating and blood residue analysis. Information provided by consultants is presented in summary form in the text with more detailed information in each appropriate appendix. In order to adequately sample regional rockshelters and properly analyze the recovered data, test excavations should be carefully designed and directed at a series of logical questions or testable hypotheses relevant to the site's and region's scientific research potential, to further our understanding of the regional archaeology (knowledge). A design for understanding the excavation is presented in Appendix 1. This multi-disciplinary approach to even so limited a project as this once again demonstrates the value, however limited, in small site archaeology.

LOCAL ENVIRONMENT

The three study rockshelters are situated in pyroclastic flow remnants of the Tuscan formation which is composed of volcanic breccia and tuff mudflows. These tuffaceous deposits have been weathered here and there more rapidly along exposed faces forming a breccia overhang or shelter. Each shelter within Antelope Creek Canyon faces southerly or southwesterly, a position favorable for winter warmth. B&B Rockshelter, within Salt Creek Canyon, on the other hand, has a west-northwest aspect and is clearly the more hidden of the shelters in terms of both topography but also current vegetation. All three rockshelters are about one-third of the way down from Hogback Ridge toward the canyon bottom at elevations ranging from 680 to 750 feet above sea level.

Figure 1



Location Map of Rockshelters

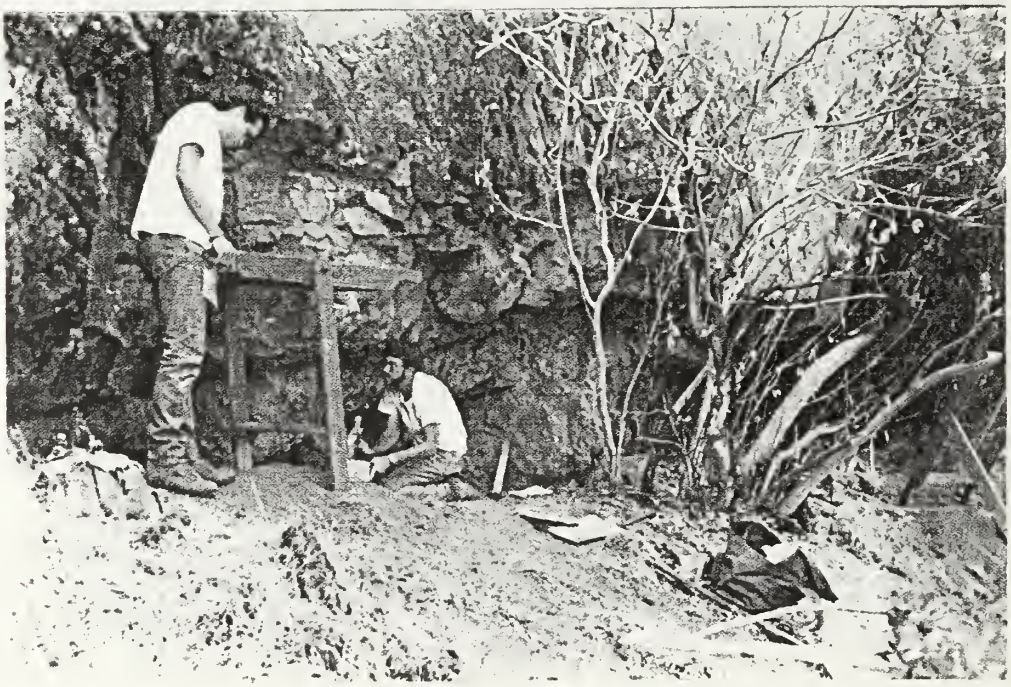
Figure 2

a. View Northwest of excavations at Blue Dick Rockshelter

b. Excavation Unit A at Blue Dick Rockshelter

Photographs of Rockshelter Excavations at Blue Dick Rockshelter (CA-TEH-1555)

Figure 3



Photographs of Rockshelter Excavations at

Pipevine Rockshelter (CA-TEH-1556) and B&B Rockshelter (CA-TEH-1554)

Broadly speaking, these shelters fall within the southern Cascade Mountains. Wiant (1981) has presented a detailed discussion of the regional environment. The principal current vegetation community around these sites is an open blue oak woodland with concentrations around Pipevine and B&B shelters of bay and buckeye trees, poison oak, and live oak. Various forbs and grasses (many introduced) are also present at all shelters. As such the location of the shelters falls within the Foothill Woodland subdivision of the Oak Grassland Province with a near element of the Chaparral Province (Munz and Keck 1959; Barbour and Majors 1997). On the broad ridge above these shelters is an open grassland, and in some places within the canyons there are patches of Chaparral, principally Ceanothus. Riparian strips coincide with the nearby perennial streams and short segments of secondary streams.

Aside from the relatively close permanent streams, a spring is located within 75 meters to the southwest from Blue Dick Rockshelter. Pipevine Rockshelter and B&B Rockshelter are situated immediately adjoining small ephemeral drainages where winter storms would provide temporary pools of water and dripping water from uphill runoff from saturated soils.

Wildlife composition is diverse and the present day distribution and density of many species no doubt differs from past levels (Wiant 1981:36). Perhaps the most significant differences are the decline in anadromous fish runs, deer herd distribution and levels and flocks of waterfowl (see Wiant 1981:182), plus the extirpation of elk, antelope and grizzly bears.

ARCHAEOLOGICAL BACKGROUND

The southern Cascade foothills, encompassing the principal drainage of Paynes, Salt, Antelope, Dye, Mill, Dry and Deer creeks, has been the scene of locally intensive archaeological survey and selective archaeological excavation, mostly on a pure research basis, but more recently land management driven. The earlier work was completed through the University of California at Berkeley's Archaeological Survey (Baumhoff 1955, 1957), and the anthropology departments at the University of California at Davis and California State University, Sacramento (Johnson 1976, 1983; Wiant 1981; Greenway 1982) and work on the Valley fringe by Shasta College (Spencer 1988). Agency work has most recently been undertaken by the Bureau of Land Management, Redding; Mountain Anthropological Research in Chico; (Ritter 1987; Nilsson, Flint and Greenway 1991; Bevill, Hull and Nilsson 1996); and by the Forest Service (work in progress).

The cultural chronology for the prehistoric period has been divided into five complexes. Baumhoff (1957) initially established a two part sequence with the late prehistoric Mill Creek Complex and the earlier Kingsley Complex. More recent work by a number of scholars has refined this sequence (e.g. Johnson n.d., Greenway 1982, Johnson and Theodoratus 1984) into five prehistoric and one contact periods or complexes. Wiant (1981:51) believes these periods are largely a representation of shifts in trade and exchange patterns and external relationships and less so due to internal socio-economic fluctuations. We must await further data before the hypotheses can be confirmed or denied. The five complexes are very briefly characterized below based primarily on data from major open villages and rockshelters:

Deadman Complex (1500 B.C.- 500 B.C.). The temporal placement of this complex is uncertain. Characteristic artifacts include milling slabs and handstones, large side-notched, and stemmed projectile points, and unifacially flaked leaf-shaped "foliates" (Greenway 1982). Where shell beads and ornaments are present, those assigned to this period by way of cross-dating (c.f. Bennyhoff and Hughes 1987) are the large, disc-shaped Haliotis shell beads, large triangular Haliotis pendants, and possibly scoop Olivella shell beads (Type C5), although Bennyhoff and Hughes (1987:124) place them later in time.

Kingsley Complex (500 B.C.-A.D. 500). Milling tools including shaped rectangular manos and milling slabs along with hopper mortars and flat-ended stone pestles are characteristic of this period. Spatulate bone tools, Haliotis disc beads, and scoop Olivella shell beads occur. The diagnostic projectile points include large side-notched and stemmed styles of basalt (Greenway 1982). Multi-family structures and cairn-covered flexed burials occur during this period.

Dry Creek Complex (A.D. 500-A.D. 1500). Milling equipment remains largely unchanged but projectile points include medium to large serrated forms and medium-sized stemmed forms (see Greenway 1982). There may be a major shift in raw material use during this period, from basalt to obsidian and chert. The burial pattern remains virtually unchanged. Shell and bone artifacts include rectangular and barrel shaped Olivella shell beads, circular Haliotis ornaments, perforated mussel shell, and deer ulna bone artifacts.

Mill Creek Complex (A.D. 1500-A.D. 1845). Significant technological changes are evident during this period as arrow points including Southern Cascade serrated and Desert series points generally of obsidian supersede the larger dart points. Milling equipment appears to remain unchanged, although there is no good quantification of mortar versus metate percentages. Clam shell and Glycymeris shell beads are present along with magnesite cylinder beads from the Coast Range. Twined basketry was recovered in dry contexts. Single family bark houses are typical where rockshelters were not utilized. Larger communal or ceremonial structures from this period have also been found.

Protohistoric Period (A.D. 1845-A.D. 1911). Artifacts from this period include Euroamerican trade goods and scavenged artifacts. Pine nut beads, Dentalium beads, spire lopped Olivella beads, and clam shell disc and Glycymeris beads are present. Pitted boulder petroglyphs are assigned to this period but probably occur at earlier sites as well.

The most recent archaeological work in the southern Cascade foothills includes a series of sites that offer contrasting environmental and cultural settings from earlier excavations which were concentrated in large rockshelters or within major midden deposits in principal canyons. Spider Rockshelter (CA-TEH-1432) proved to be a probable single family secondary occupation retreat used sporadically over the last several thousand years as opposed to a special task location. This pattern fits the dispersed foraging model of late prehistoric small shelter bases as reported by Dreyer (1984) for foothill locations to the south in Butte County.

Relatively minimal levels of food processing, cooking, and consumption utilizing basic equipment were noted and at least one individual was buried within the shelter apron. Overall, shelter use seemed a microcosm of use at larger villages and rockshelters (Ritter 1987:45).

At CA-TEH-1490, an open site near Manton, Hamusek (1988:2) recovered information suggesting it "is a temporary Yana hunting camp which was predominantly occupied during the Kingsley and Dye Creek stages spanning the period of A.D. 1 to A.D. 1300". However, later in the report (1988:70) she indicates that "CA-TEH-1490's characteristics reflect occupation".

Excavations at two sites in the Ishi Wilderness (Bevill et al. 1996) provide some interesting comparative data. Both sites (CA-TEH-563 and FS 05-06-51-40) were occupied or used from approximately 2000 years ago into the contact period. The early Kingsley Complex components suggest short term, intermittent residency followed by a long sequence of more sedentary logistically oriented peoples. Hunting evidence, especially artiodactyla, is prevalent with a use of varied local plants. Up to six sources of obsidian were used in certain flaked stone tool manufacture processes. Winter use, at least, is likely for most of the occupational sequence, especially at FS 05-06-51-40.

ETHNOGRAPHIC BACKGROUND

A short sketch of the local ethnography is offered with attention centered on cultural aspects primarily related to settlement, subsistence, technology, social organization, and trade-exchange. More detailed information is available through such works as Powers (1877), Waterman (1918), Gifford and Klimek (1939), Sapir and Spier (1943), Johnson (1978), and Jensen and Reed (1979).

This offering sets some of the comparative baseline for the archaeological record with the caveat that cultures change and the direct historical approach can only be applied so far, i.e. with some certainty for some practices over the last few centuries or so. Furthermore, the ethnographic record for the Yana, a depressed and decimated

group by the time ethnographers became active, is somewhat fragmentary, although Ishi's amazing life and accounts provide a valuable window into many aspects of Yahi-Yana life (see Waterman 1918; Kroeber 1961), albeit with some acculturation.

The study sites fall within Southern Yana territory. These were Hokan speakers who were structured into tribelets or relatively anonymous groups consisting of a number of small villages centered on a larger village where the ceremonial house was placed. Conical bark houses were the common type, although rockshelters were also utilized.

The Yana were relatively mobile hunters and foragers with seasonal fishing activities very important to the diet and site patterning. Acorns formed the principal plant food but with a broad range of other vegetal foods including pine nuts, buckeye, grasses, tubers, bulbs, and berries. While all members of a local group participated in occasional communal deer hunts, men were the principal hunters and women the main gatherers. Other foods included rabbits and rodents, quail and other birds, grasshoppers, and other insects and grubs.

Technologically the Yana used the bow and arrow, fish harpoons, baskets, hopper mortars, flat-ended pestles, the mano and metate, and a variety of bone tools including wedges, awls, fish gorges, gaming pieces, and harpoon toggles. Various leather and fiber goods, such as milkweed ropes, cordage, caps, shirts, and fish nets, and animal robes and blankets were known. Obsidian was procured from the Achomawi and Shasta, although float in the local creeks of Tuscan obsidian and a source south of Lassen Peak were more immediately available. Shellfish beads and ornaments were introduced from westerly sources.

GEOARCHAEOLOGY

Observations regarding the physical properties of the soils/sediments of each of the three rockshelters were conducted during excavation as part of the unit/level recording process and more generally within the field notes. Chemical and physical testing of soils/sediment properties was performed on a limited number of samples from each site (and one off-site sample for comparison) by the Soils and Physical Geography Lab of the University of Wisconsin - Milwaukee (Table 1). Field and laboratory results combine to offer limited insights regarding intensity of site use, past environmental conditions, natural factors affecting occupation, disturbance factors, and stratigraphic and horizontal variation in site activities and site formation factors.

Table 1

Soil Sediment Properties

Sample #	Sample ID	pH	OM	P	K	Mg	Sol Salts	%Sand	%Silt	%Clay
1	1554	6.0	1.8	1.5	17	208	33	76	24	0
2	1555 Unit A	6.0	3.0	2.0	31	527	74	54	44	2
3	1555 Unit B	6.1	2.8	2.0	6	349	56	54	41	5
4	1555 Off	6.3	3.8	2.0	11	332	46	58	40	2
5	1556	6.2	6.2	2.0	25	122	91	50	48	2

Sampling factors aside, a careful study of the sediments, chemical residues, and sedimentation of an archaeological site is required to identify or make clearer the cultural component of the site matrix (Stein 1985:5). The four important factors are source, transportation mechanisms, deposition environment, and post-deposition environment. An examination of those physical and chemical properties of the soil/sediments thought meaningful for each site, based on previous regional research and an analysis of the local geomorphology and soils, potentially can lead to the identification of the nature of each of these factors as well as the natural and/or cultural agents responsible. Off-site sample studies for baseline comparisons are essential, since it is assumed the physical and chemical processes involved in the creation of a sediment are uniform in time and space. However, open versus closed or

semi-closed sites must be weighed in the comparisons. In this manner human and natural agents can be factored out in the formation analysis.

In two of the three shelters (Blue Dick and Pipevine), there was a reasonably clean demarcation of deposit extent based on soil color and artifact distribution. For B&B Rockshelter, there was no such distinction and the extent of deposit was estimated based on the test results, extent of shelter, and terrain factors, such as slope and rock exposure, and artifact distribution (or lack thereof).

All three of the rockshelters exhibit shallow cultural deposits, generally less than 40 cm. There is no obvious (visual or physio-chemical as noted below) culturally - related stratigraphic breaks. What occupation evidence there is as derived from the soil-sediment analyses (low pH, P, organic matter, relatively light soil color) suggests none of these rockshelters was occupied or used extensively or consistently over a long period of time. This, of course, is in agreement with the amount of cultural remains evident. Occupation/use was not confined solely within the shelter overhang but included areas just outside on the apron.

We would expect that a certain amount of the cultural evidence outside the mouth of each shelter may represent secondary deposition or discard from activities that occurred within the shelter itself. The presence of a burial within the apron of B&B Rockshelter illustrates primary use of this area at the shelter.

Each rockshelter appears initially to have had a shallow soil or sediment layer produced by decomposing rock floor and roof particles probably along with a little eolian dust and leavings from decayed vegetation and animal activities and their remains. Use of the shelter occurred on this thin bed over time producing a shallow midden. After permanent site abandonment a thin natural soil has begun to develop as a result of decaying vegetation, bioturbation activities, wind borne deposits, and weathered roof remains. Within the shelter aprons there appears to have been some minor colluvial movement and possibly sheet deposition, although this was not empirically determined.

Rodents have clearly churned the deposits mixing pre- and post-use sediments with midden materials. We would judge that perhaps 50% or more of the deposit has been churned. Ash lenses and the one burial are still definable and, in effect, are clearly the remains of human agents of bioturbation. While there was a minor buildup of midden at each site from human use, there undoubtedly was also some disturbance to prior midden deposits, if present.

Setting aside for the moment the artificial and ecofactual evidence, the chemical tests and soil/sediment analysis provide some clues to the level of site use. The pH within the sites is actually slightly more acidic than the off site sample, but all readings vary little, in the 6.0-6.3 range, or medium acid to slightly acid. Cornwall (1958:193) and Setzer (1947:57) have discussed the contribution bases (carbonates) from burning, baking, trash disposal, etc. make to a deposit thereby raising the values in comparison to areas of little or no human activity. Clearly, the cultural contributions to the shelter deposits have been relatively slight.

Organic matter, also a potential indicator of cultural contributions to a deposit, is relatively the same between the off-site sample and those samples tested at B&B and Blue Dick rockshelters. A somewhat higher reading (6.2%) resulted from a test on the sample from the 10-20 cm level at Pipevine Rockshelter (Table 1). This shelter appears to have been utilized more than the other two based on this soil factor alone. The sample also happens to have the lowest Mg reading of all the samples and the highest reading on soluble salts. Otherwise, the Mg, soluble salt, organic matter, P and K readings show variations that do not appear meaningful in terms of human use variations. The available P readings may be misleading. It would appear that these sites have relatively high amounts of carbonates present, probably from the local volcanic materials. As such the exchangeable P may have become bound up with Ca and thus prove an unreliable indication of human use variation ($CaCO_3$ residues were found on the larger artifacts and cobbles.). In the future total P would be a better test to run.

Overall, the soil analysis provides only a hint of inter-site variation and no evidence of different episodes of occupation. One could make a case that more sampling and cross-site trenching would allow a better basis for a geoarchaeological analysis. However, in absence of such it would appear that we are not dealing with a complex

site occupational history at any of the shelters, and that bioturbation factors have considerably mixed what deposits are present. There is thus no suggestion of culture breaks. B&B Rockshelter exhibits a near-surface ashy zone suggesting a fire episode, probably a brush fire that may have occurred post-use.

The soils surrounding these site have been classified by Gowans (1967:64:65, sheet 69) as Toomes very rocky loam, 30 to 50 percent slopes. A typical profile includes a shallow A11 horizon of brown (7.5 YR 5/4-dry) gritty loam; weak, thin, platy structure; slightly hard when dry, friable when moist; slight acid, many fine pores, and 20% stones. An abrupt, smooth boundary separates this horizon from the underlying A12 horizon, up to 12 inches thick, also a brown (7.5 YR 4/4-dry) gravelly heavy loam; moderate, medium subangular blocky structure; slightly hard when dry, friable when moist, slightly acid, overlying volcanic breccia.

EXCAVATION STRATEGY

The field methods used at the three rockshelters generally followed a similar pattern. Initial color transparencies and black and white photographs were taken of the sites as part of the original site recording and pre-excavation scoping process. Then a steel rod or piece of rebar was driven into the deposit near the rear of the shelter. From this datum, one or two lines in a cardinal direction were laid out with measuring tape and hand-held compass. Stakes were periodically placed at even meter intervals along the baseline. From these baselines units were intuitively selected for excavation. These baselines also assisted in completing cross-sections and site maps through use of compass, measuring tape and graph paper.

During data recovery, except as noted below, excavations were conducted using arbitrary 10 cm levels (in the absence of known stratigraphy) following the ground contour. Soil/sediment/midden was excavated with a trowel and whiskbroom and materials were either placed into a dustpan and then into a bucket for transportation to the screen or the loosened materials were directly shoveled into the screen. All Units were later backfilled. Materials recovered from the screening were placed into labeled vials or paper bags for removal to the lab. Charcoal samples were carefully place into tin foil containers by trowel end or tweezers. Standard forms based on California State University, Chico; University of California, Davis; and California State Department of Parks and Recreation formats were used. Soil, flotation, charcoal and other samples were periodically secured from select units and placed into tinfoil or plastic containers depending on material.

B&B Rockshelter (Figures 4 and 5)

At this shelter Unit A was intuitively placed in the heart of the shelter at its mouth. The 1 m x 1 m unit was excavated to bedrock with 1/4" screen used during the recovery process. From the 10-20 cm level and the 20-30 cm level 1/2 of a #10 bucket was screened through a 850 micrometer hand screen. A hand lens was used to scan the residue for micro flakes and seed/faunal materials. Unit B was placed in a small side chamber of the site, within a possible cache area. It was also postulated that, lacking cultural material, this unit would provide a set of natural fauna remains for comparison with faunal remains from the cultural deposit. The unit was 0.5 m x 0.5 m in size. A 1/8" screen was used here. Unit C, another 0.5 m x 0.5 m unit, was placed within the talus in front of the shelter to check for midden extent and depth.

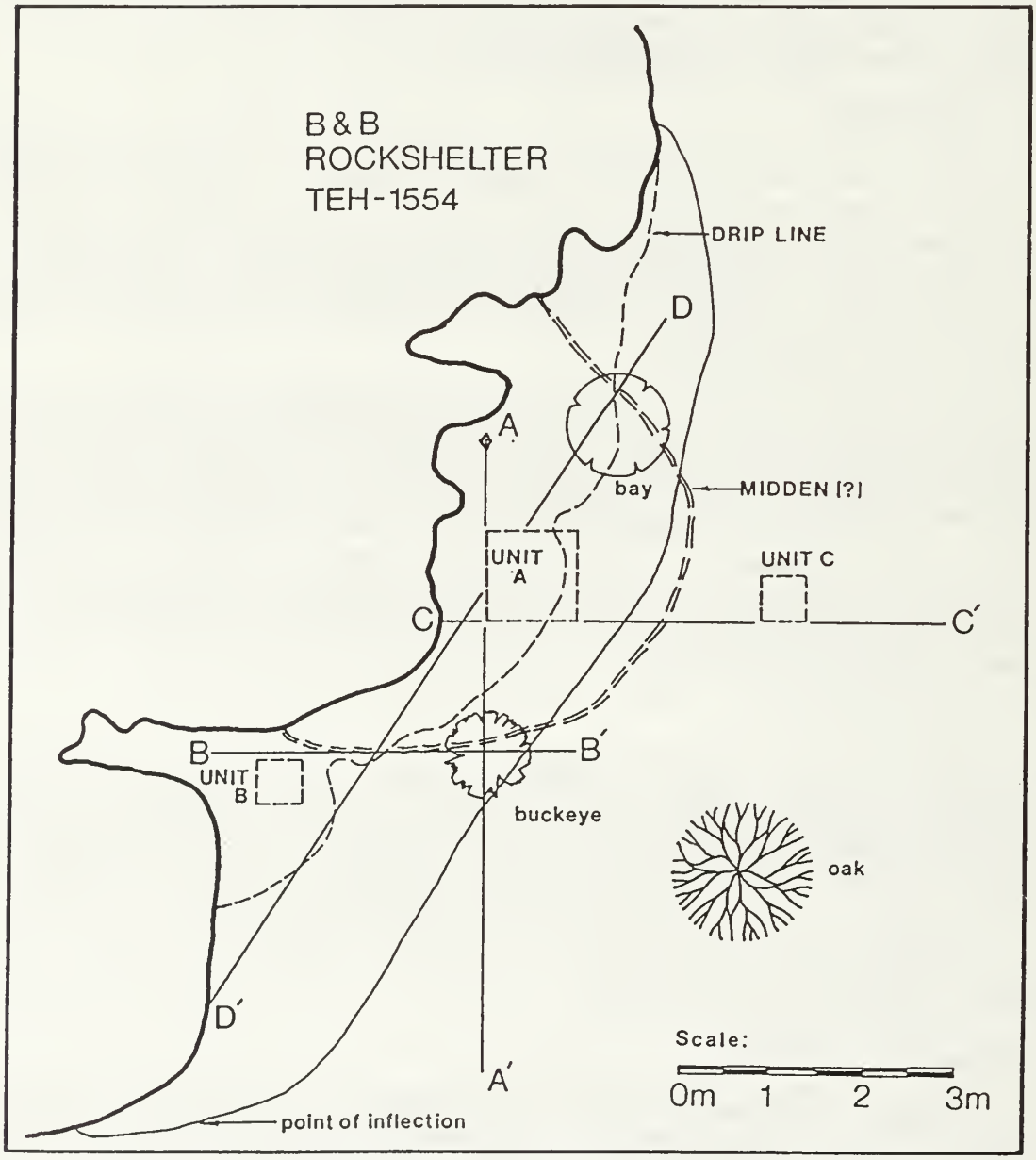
Blue Dick Rockshelter (Figures 6 and 7)

Two 1 m x 1 m units were placed along the baseline 3 m from one another with one on each side of the baseline. These units were arbitrarily place to sample the midden near the inner, back wall portion of the shelter and the outer apron area. Screens used were 1/4" mesh. As with the other sites, black and white photographs and color transparencies were taken during the excavation process.

Pipevine Rockshelter (Figures 8 and 9)

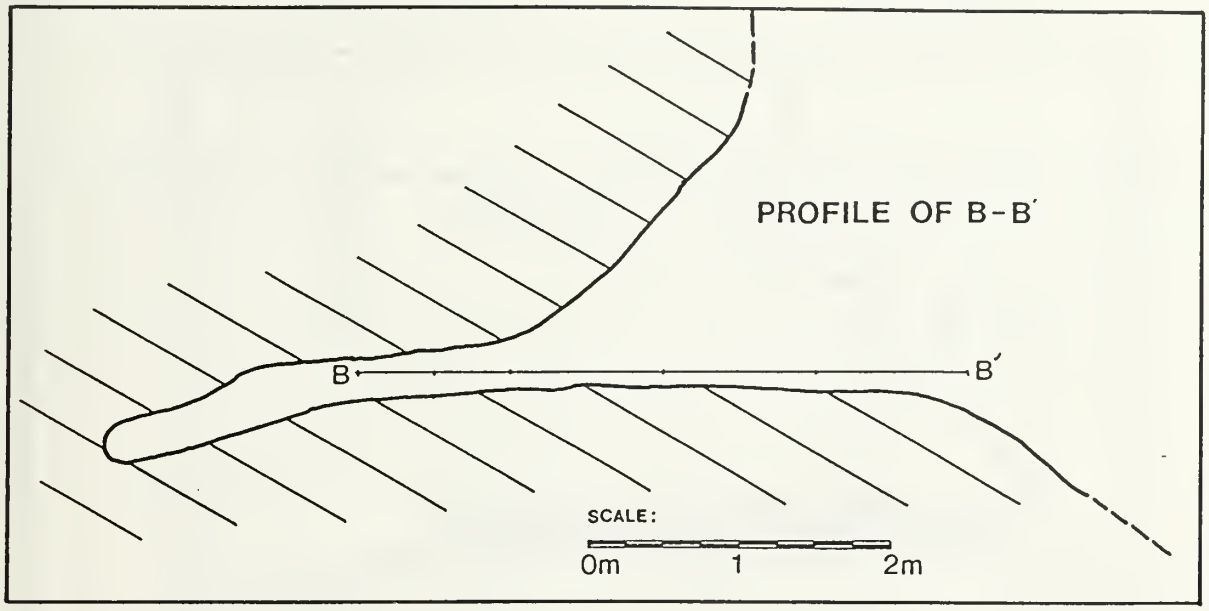
Units were intuitively situated at this site to acquire samples from the flat midden area within the shelter and from an area of midden outside within a boulder field down slope. The spaced units within the shelter were 1 m x 1

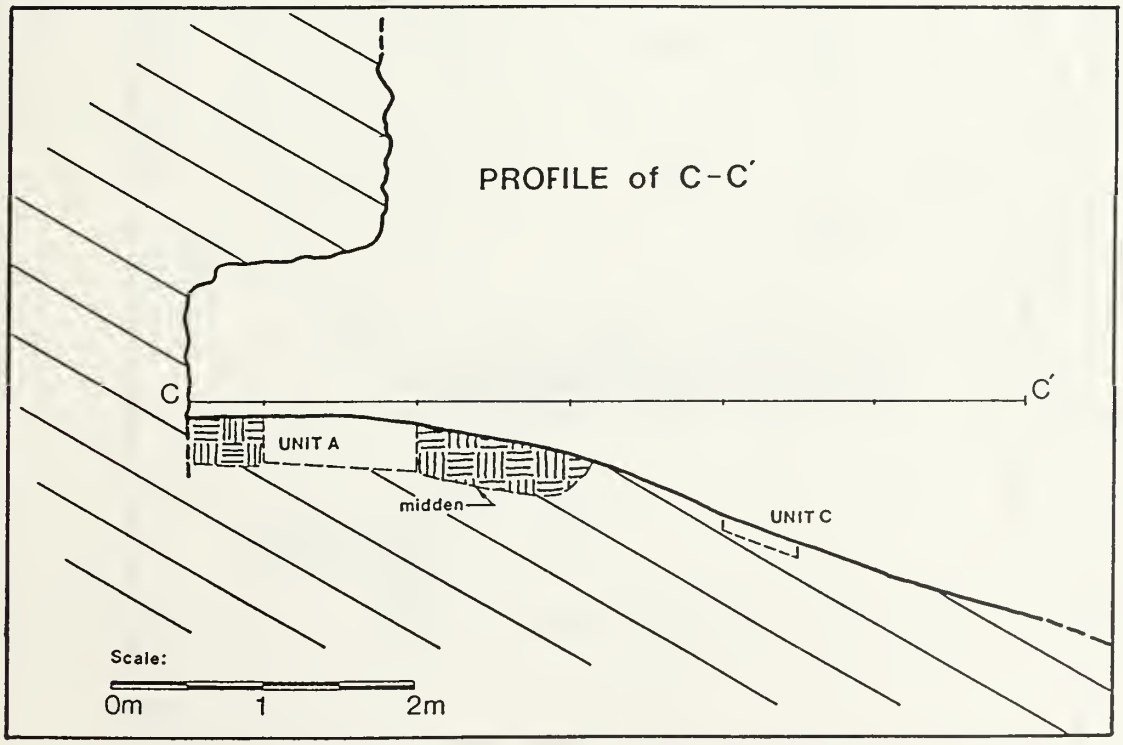
Figure 4



Plan Drawing of CA-TEH-1554 (B&B Rockshelter) with excavation unit locations

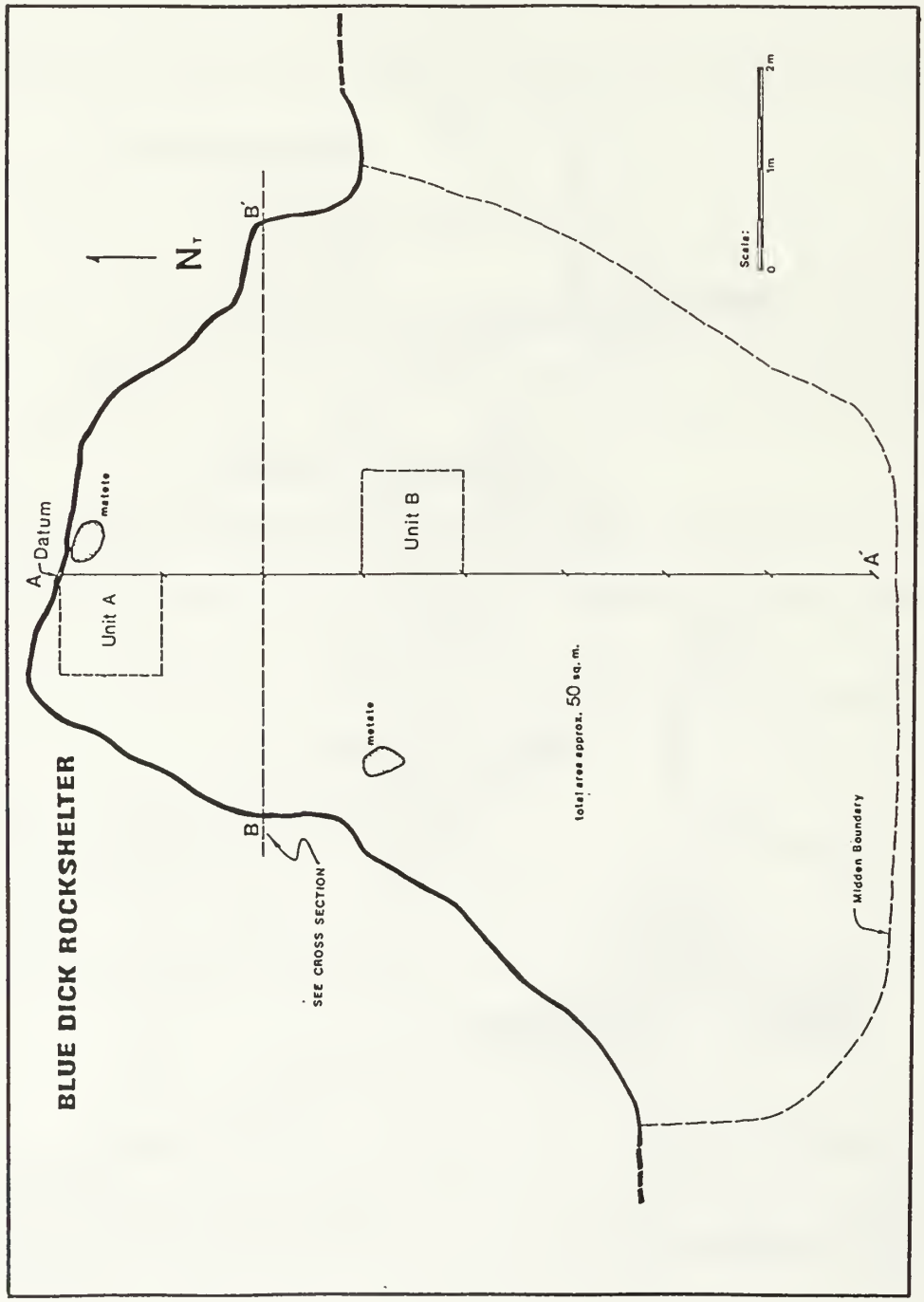
Figure 5





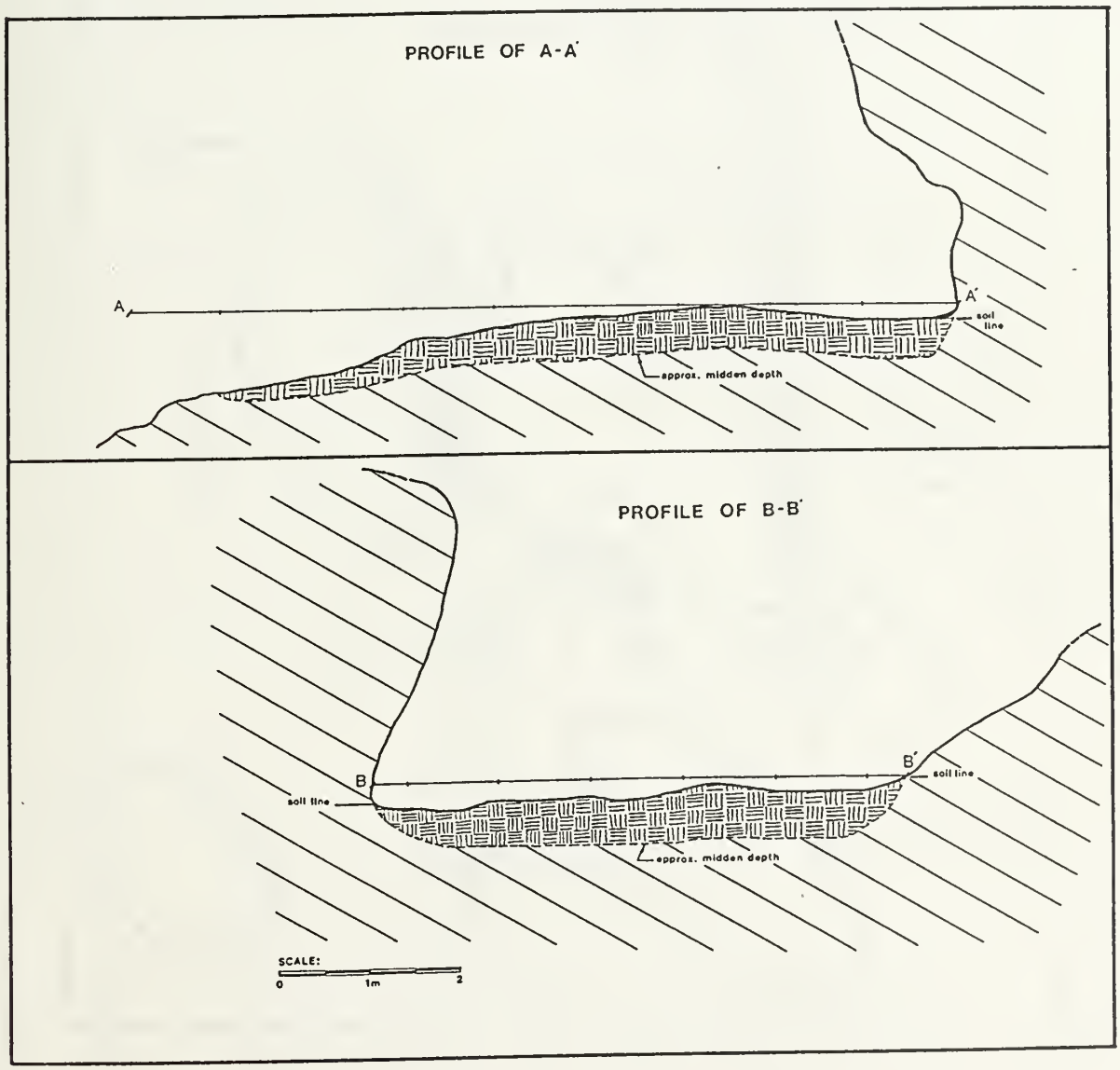
Lateral Cross-section of CA-TEH-1554 (B&B Rockshelter)

Figure 6



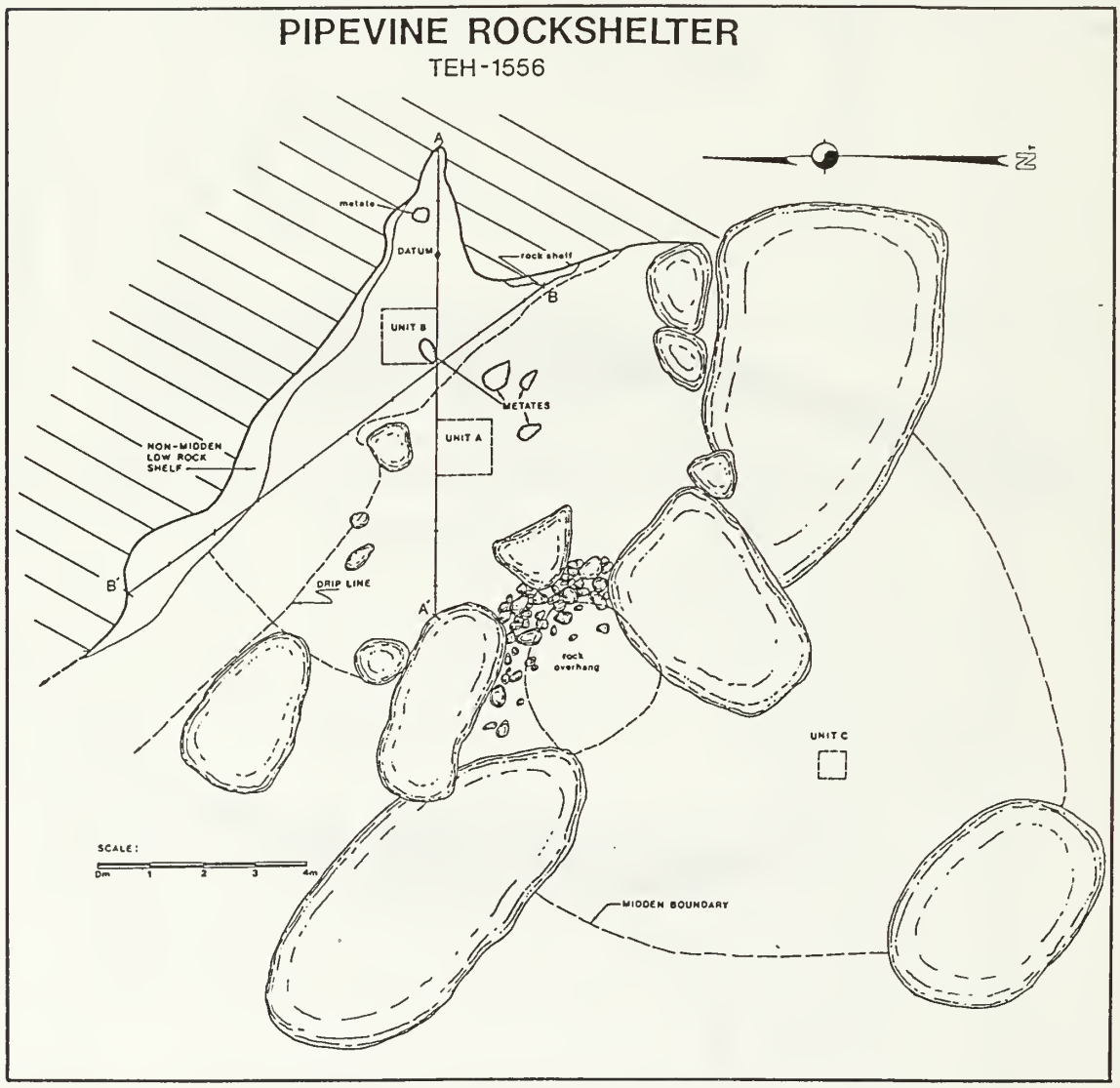
Plan Drawing of CA-TEH-1555 (Blue Dick Rockshelter) with excavation unit locations

Figure 7



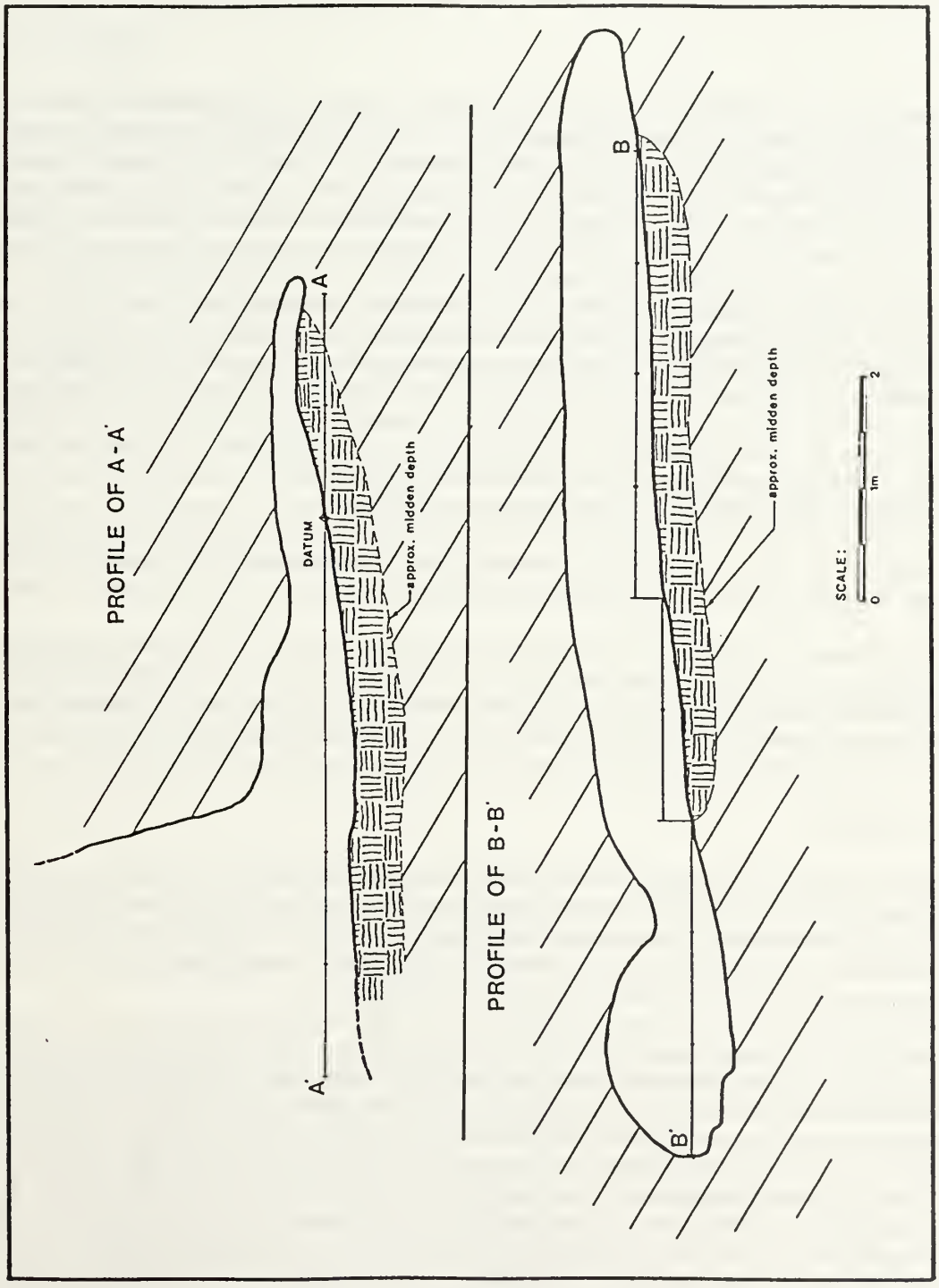
Lateral Cross-section of CA-TEH-1555 (Blue Dick Rockshelter)

Figure 8



Plan Drawing of CA-TEH-1556 (Pipevine Rockshelter)

Figure 9



Lateral Cross-section of CA-TEH-1556 (Pipevine Rockshelter)

m placed along the east-west baseline. The unit in front of the shelter within the boulder/midden talus was 0.5 x 0.5 m in size. A tape measure and plumb bob were necessary to place this midden accurately within the grid system. A series of ground squirrel or other rodent backdirt piles from burrows was present in the boulder talus area. Three of these 20-25 cm high mounds were screened using 1/4" mesh, amounting to approximately 20 #10 buckets. On this and the previous site, midden extent was mapped based on color variation only.

FEATURES

A whitish-brown ashy lens was recorded in Unit A of Pipevine Rockshelter at a depth between five and 28 cm. The feature is mostly ash with some scattered charcoal. There were a few scattered fire-affected and cracked rock in the vicinity of the probable hearth, but no clear-cut association could be established. The lens is about 60 cm long by 18 cm wide, although it varied in extent somewhat by depth. It is possible that more than one hearth episode is represented by this feature. Furthermore, it is clear that some of the ash has been redeposited in krotovina. In all likelihood this feature was the result of small, relatively low-temperature heating and cooking fires at the shelter mouth. Charcoal from the feature provided an uncorrected radiocarbon date of 330$\pm$ 50 B.P. (A.D. 1620) Beta-47055 (refer to Appendix 2). Within Unit B of Pipevine Rockshelter at a depth of 10-30 cm and directly on bedrock was encountered a small rock cairn and adjoining whitish-gray ashy zone (Fig. 19). Part of this feature extends into the adjoining unit. The portion exposed measures 72 cm east-west by 38 cm plus north-south. Within the cairn is a rounded slab metate. Charcoal occurs within the ashy zone. The initial impression this feature leaves is a burial cairn. In fact, one possible infant cranium fragment was found under the edge of the metate, and the remains of the burial may be in the adjoining unexcavated deposit. The cairn sits directly on bedrock. Even if the cairn had "settled", one would expect more human bone in the feature vicinity. Still, translocation of small, light infant bones by rodents is also a possibility.

At B&B Rockshelter within Unit A, 0-10 cm level, ashy and oxidized sediment patches were noted. These patches, however, being so close to the surface may be the result of natural fires which periodically sweep the countryside.

At the very rear of Blue Dick Rockshelter within Unit A at a depth of 10 to 30 cm and just above bedrock occurred scattered small patches of whitish-gray ash and orange-brown oxidized sediments. These areas were diffuse and a feature designation per se was not applied. However, this unit is in the only real overhang portion of the rockshelter usable by humans. It would be the likely location for a small heating and cooking fire as described above.

FAUNAL REMAINS

As indicated in Appendix 3, by Nancy Valente, there was a moderate amount of faunal remains recovered considering the small size of excavated materials. While this sample is no doubt biased to some extent due to low percentage sampling, taphonomic factors, consumption/disposal patterns, etc., it provides some information on site function, potential diet, and animal procurement practices for this foothill location in late prehistoric times. At least it forms a component for further hypothesis testing and model building.

The results from the three rockshelters are not too surprising, although there is some variety in the findings. There is considerable evidence of bioturbation in the rodent, squirrel, rattlesnake and beetle remains. The other fauna and the often fractured and burnt condition, including evidence of butchering at CA-TEH-1554, point toward meat and bone marrow processing at the shelters and a suggestion of residency. Deer, rabbit and hare remains are expected food leavings based on ethnographic accounts and other regional late prehistoric site results (Ritter 1987, Bevill et al. 1996). What is somewhat surprising is the relative diversity of the probable utilized remains including skunk, bird, pond turtle, fresh water mussel, and possibly rodent. However, there are no fish evident even with permanent streams close at hand. This may simply be the result of bone processing (grinding for meal) and/or disposal elsewhere. The faunal remains hint at fall-winter use when deer would have migrated into the location from higher elevations and creeks would be low and shellfish and pond turtles available. The presence of acorn remains as discussed in the next section suggests at least fall use of the shelters.

Overall, while deer remains are relatively common in the sample, the data are not sufficient to suggest a regional resource depression concomitant with population increase (see Bayham and Broughton 1990). If anything, the data suggest late prehistoric dispersion of camps to better exploit dispersed resources. This pattern could result in the absence of fish remains, processing and disposal factors aside.

FLORISTIC REMAINS

The remains of flora from two of the rockshelters were examined by Eric Wohlgemuth (see Appendix 4). While wood charcoal was present in some quantity, a low frequency of seed remains was recovered. This is possibly a sampling problem as only a small portion of the cultural deposit was examined. Furthermore, certain geophytes such as *Allium*, *Brodiaea*, *Calochortus*, *Chloragalum*, *Dichelostemma*, *Periderida*, *Sanicula and Triteleia* are, as a whole, locally abundant today and probably offered an important food base in the past (Anderson 1997). These various corms, bulbs, tubers and rhizomes would not preserve well in the sites.

Wohlgemuth believes the scarcity of seed remains argues for short duration occupation. Those seeds that were most abundant include acorn (food), bedstraw (bedding?), clover and grass, and possibly carrot family, the latter two possibly suggesting very tentatively late spring to mid-summer use depending on species, ripening time, and how long the seeds stayed on the plant after maturation. Introduction by natural means for these latter seeds cannot be dismissed.

The acorn presence suggests fall use. Tentatively, the flora and fauna are suggestive of use during most seasons, although mid-summer occupation seems least likely. What we cannot predict is how continuous occupation was at any one shelter, both on a yearly basis and at a greater interval. It is apparent that use was neither intense nor was it represented by more than a few people for a short duration.

HUMAN BURIAL

Within B&B Rockshelter at a depth of 23 cm from the surface in Unit A the remains of an infant were discovered and exposed. The burial had been placed just on top of the volcanic bedrock within the shelter apron. No distinct burial pit was noted, probably because of post-interment bioturbation. In fact, the burial itself appears to have been disturbed by rodents burrowing as the bones were somewhat scattered. Only the upper portion of the burial is present within the unit.

Those human bones exposed at B&B include the cranium, left humerus, four ribs, one vertebra, and a phalange. The head appears to face west, out into the canyon, but the exact orientation and positioning of the body other than on its left side could not be determined. There were no grave goods apparent. After exposing the remains and photographing and drawing the burial, it was covered in place.

The inhumation of the dead within the apron of a small rockshelter appears to be a common practice in the southern Cascade foothills. A similar burial was found in Mill Creek Canyon at Spider Rockshelter (CA-TEH-1432) and one is known from a rockshelter (CA-BUT-7) in Mud Creek Canyon excavated by UCLA and Chico State (unpublished data, on file with the Department of Anthropology, California State University, Chico). A child's burial was found by Sundahl (1993:117) at Porcupine Rockshelter (CA-TEH-1526) on the Valley's edge near Bend. Wiant (1981:57) notes that: "Some of the earlier inhumations from the Kingsley Complex have rock cairns", as did the Spider Rockshelter individual. However, this is probably not a temporal marker since the basic methods used to dispose of the dead apparently changed little over the last 2500 years (Wiant 1981:56). The lack of a cairn on this B&B infant may be due to its age and relative status within the group. Native American informant Barbara Murphy of the Redding Rancheria, whom we consulted regarding the burial finding, suggested the burial was a stillborn infant, with the shelter having served as a birthing location (personal communication 1991). The possibility of a second infant human interment at Pipevine Rockshelter is discussed under the Feature 2 heading.

GROUND STONE

Metates

A single unifacial, unshaped blocky rectangular andesite metate (455-22) was found on the surface of B&B Rockshelter (CA-TEH-1554) (Figure 10). The milling surface is flat, exhibiting minor use. (The andesite specimen measures 22.5 cm long, 20.0 cm wide, and 12.0 cm thick.) As with all the metates discovered, local natural flat boulders served as the milling implements requiring virtually no modification. (See Table 2 for metate measurements). At Blue Dick Rockshelter two andesite unifacial, unshaped block or slab metates were noted, measured and drawn. The first specimen, 454-1 (Figure 11), is somewhat ovate in outline (measuring 50 cm in length by 33 cm in width by 15 cm in thickness). Much of the flat surface shows evidence of grinding.

The second metate from Blue Dick Rockshelter (454-2) is pear-shaped in outline exhibiting a central area of grinding (Figure 11). (The artifact measures 43 cm in length, 30 cm in width, and 15 cm in thickness.)

The largest number of metates (five) comes from Pipevine Rockshelter (CA-TEH-1556). Four were documented on the surface and one was discovered in Unit B at a depth of 10 cm composing part of Feature 2 and possibly representing a portion of a burial cairn (Fig. 19). All of these tools are relatively portable, minimally shaped unifacial andesite boulder slabs that were used as grinding bases. All have flat grinding surfaces.

The first metate (473-60), from the feature, is oval in outline (measuring 41 cm in length, 22 cm in width, and 12 cm thick.) Two main areas of stone on stone milling are evident (Figure 12). There may be some minor shaping of the metate's periphery.

The second metate (473-61) is a relatively thin (8 cm) slab with a narrow (13 cm wide) main "swath" of grinding attrition evident (Figure 13). The slab is 58 cm long and 42 cm wide.

An irregularly shaped block, possibly slightly modified along a portion of the periphery, constitutes the third metate (473-62) (Figure 14). Much of one of the main surfaces exhibits grinding.

The fourth metate (473-63), a slab form, is somewhat oval in outline with a central concentration of grinding (Figure 14).

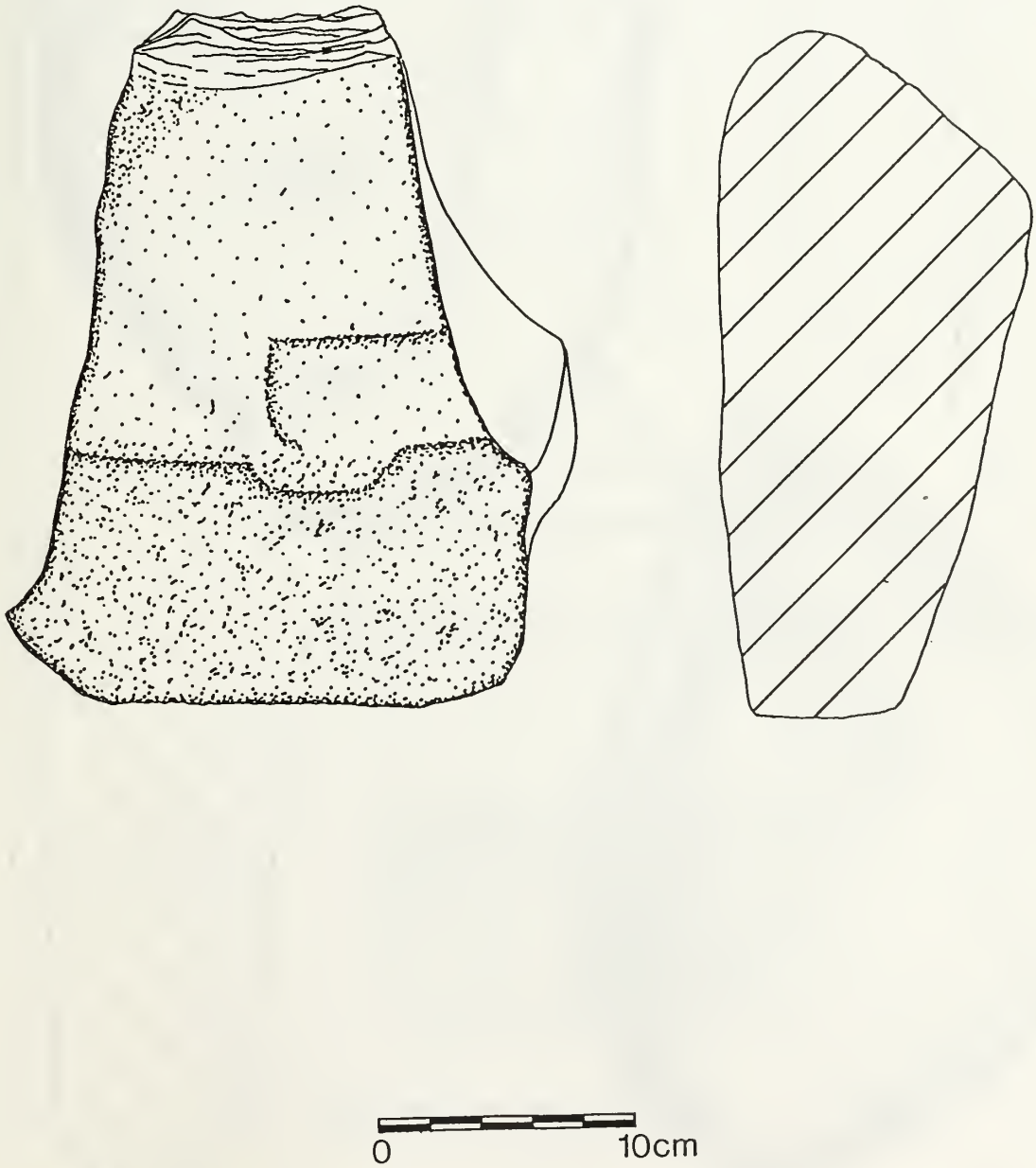
The final metate (473-64) has a quadrilateral outline with considerable grinding on the main face (Figure 12).

At Spider Rockshelter (CA-TEH-1432), on Mill Creek, a site of similar proportions to at least Pipevine Rockshelter, four block metates, a bedrock hopper mortar and three manos were recovered (Ritter 1987:14-15). The metates and manos generally match those from the Hogback sites studied here.

Johnson (1984:190-192) has discussed southern Cascade metates in some detail, dealing with a sample of 506 from 127 sites. Of those analyzed, 494 were unshaped as "Apparently the rough exterior of the field stones was preferred. Few of the specimen were used intensively enough to wear a deep concave grinding pit into the stone (Johnson 1984:191)." Johnson's size ranges match these specimens.

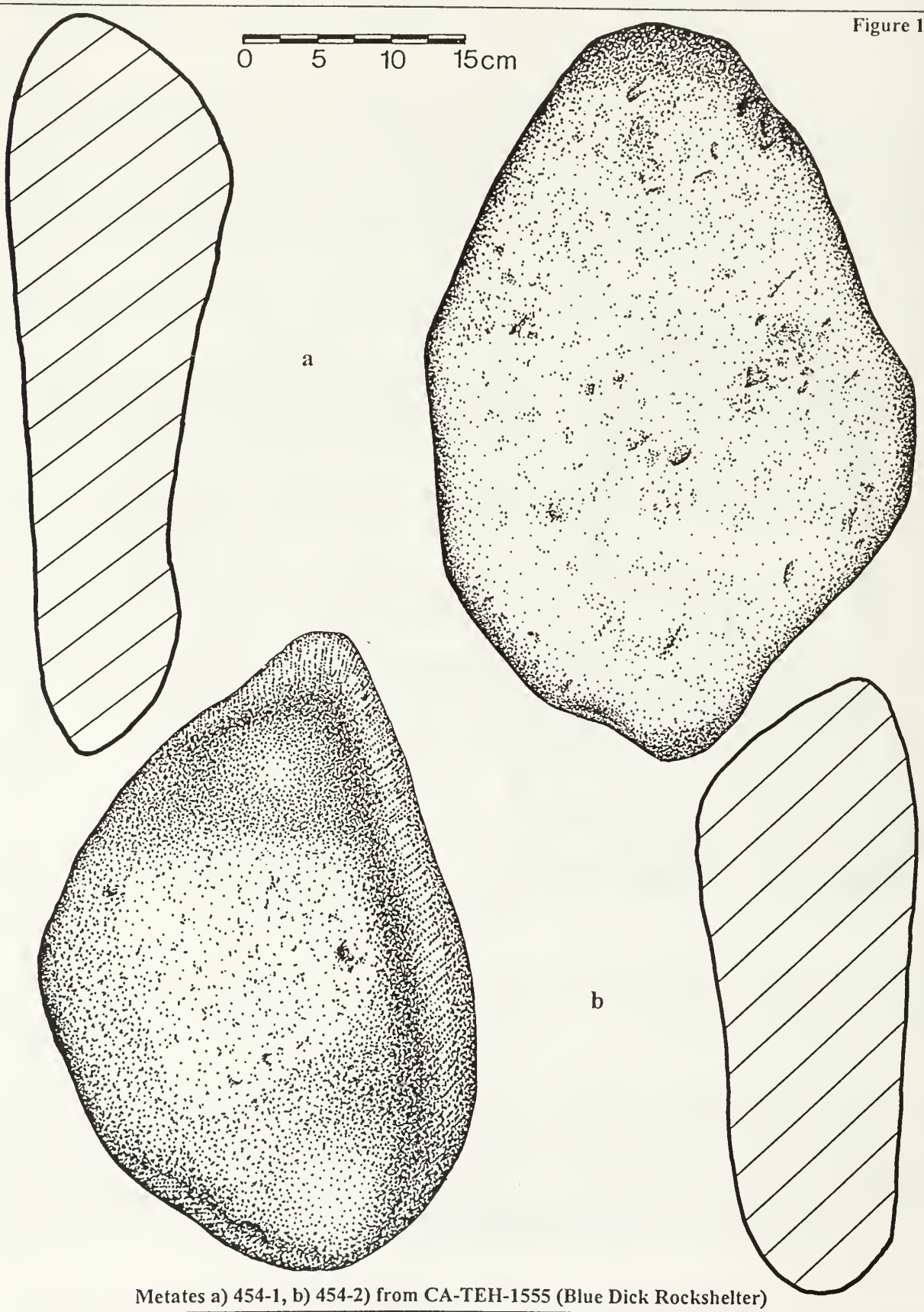
It does not appear that the manos and metates recovered from the rockshelters are good chronological indicators. Johnson (1984:450-453) believes the earliest evidence for their occurrence in the southern Cascades is about 4500 years ago with the first use of mortars and pestles beginning about 3000 years ago, with use of both up to the historic. The absence of mortars and pestles from the rockshelter deposit is perhaps a product of sampling, although more likely it may reflect a functional variation in site use, where the study site's food processing focused less on softer food products such as acorns, bulbs, tubers, corms, rhizomes, rodents, etc. In any case, the mortar and pestle was never the dominant food processing tool set in the region, following Johnson (1984:453).

Figure 10



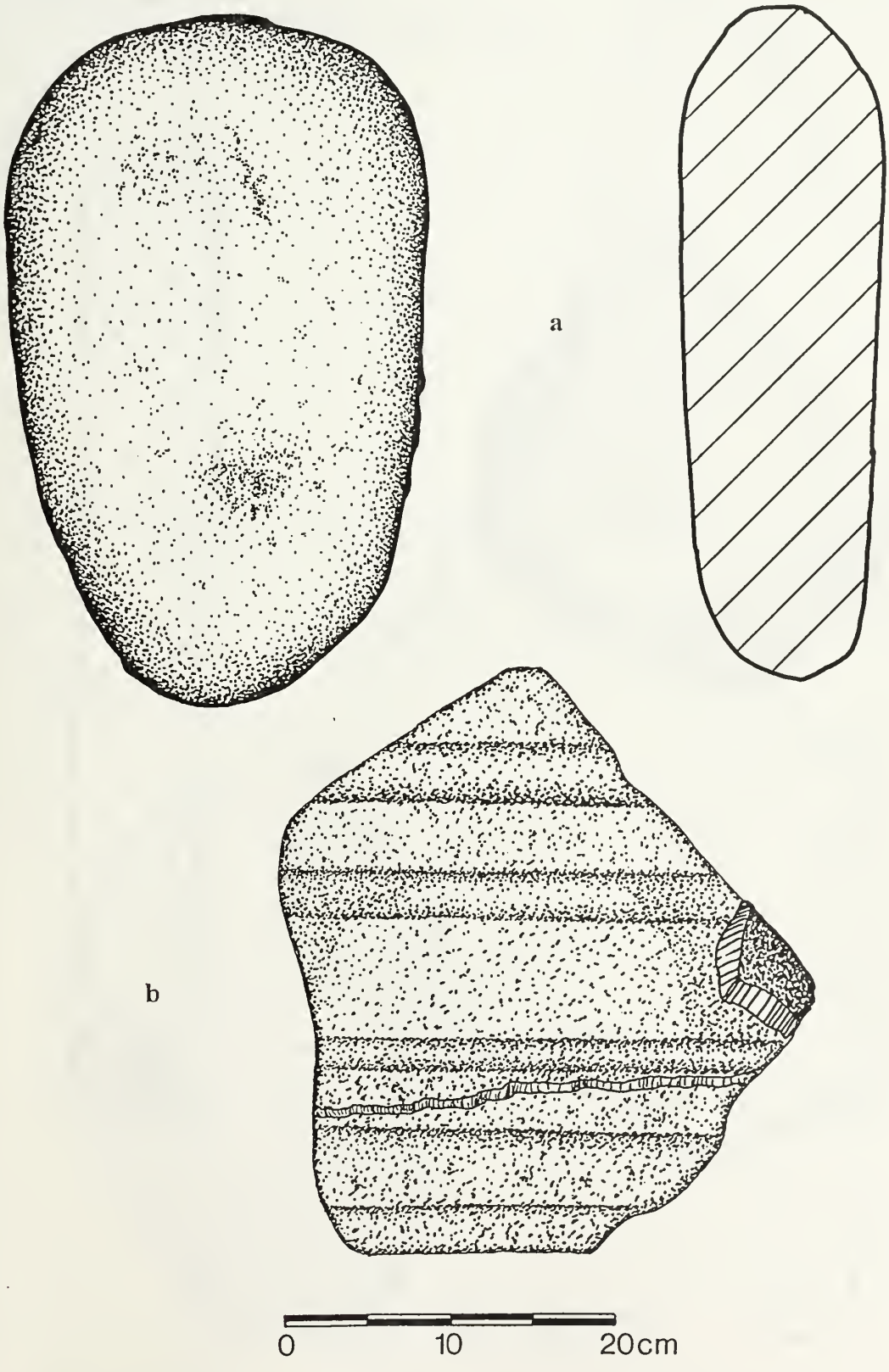
Metate (455-22) from CA-TEH-1554 (B&B Rockshelter)

Figure 11



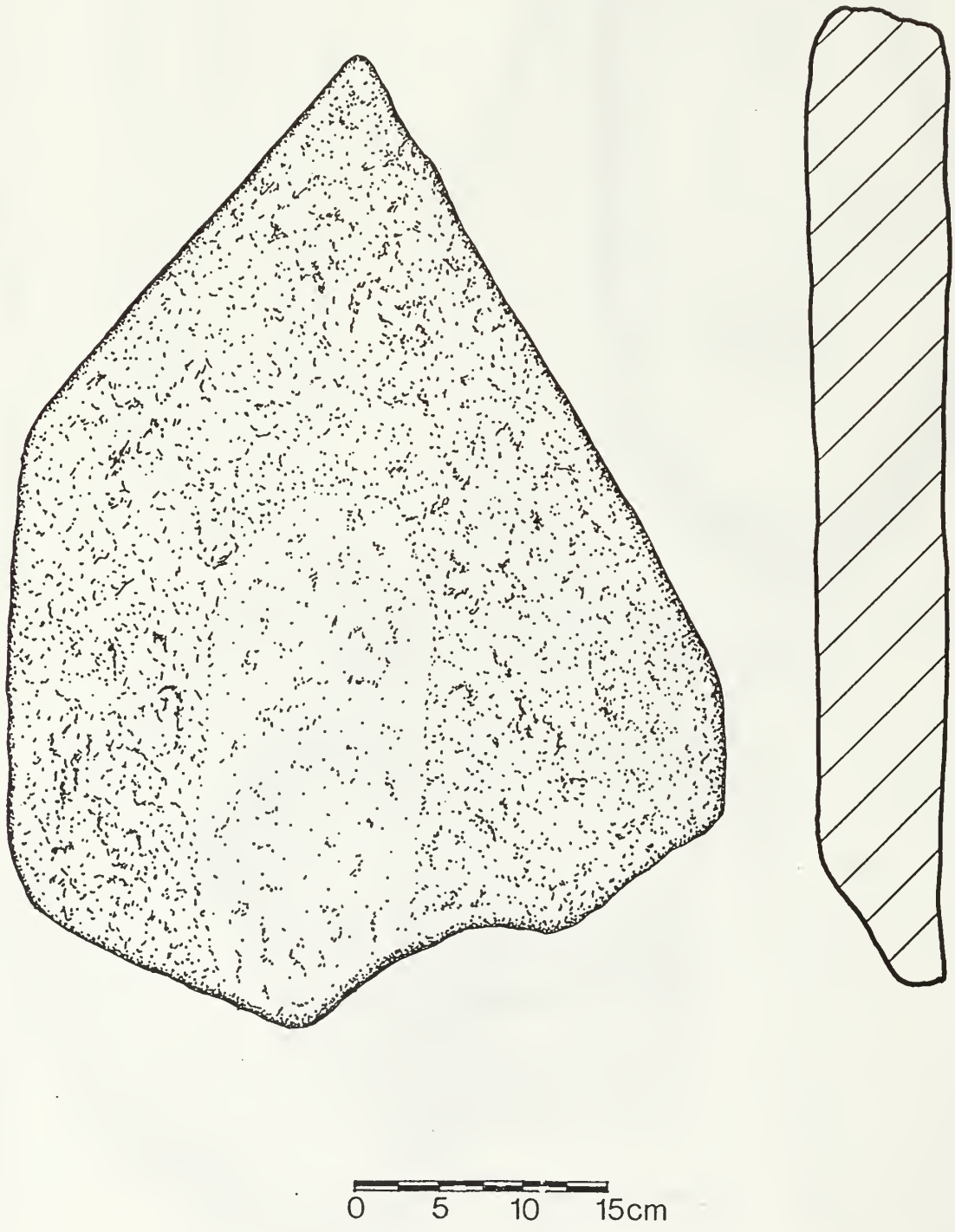
Metates a) 454-1, b) 454-2) from CA-TEH-1555 (Blue Dick Rockshelter)

Figure 12



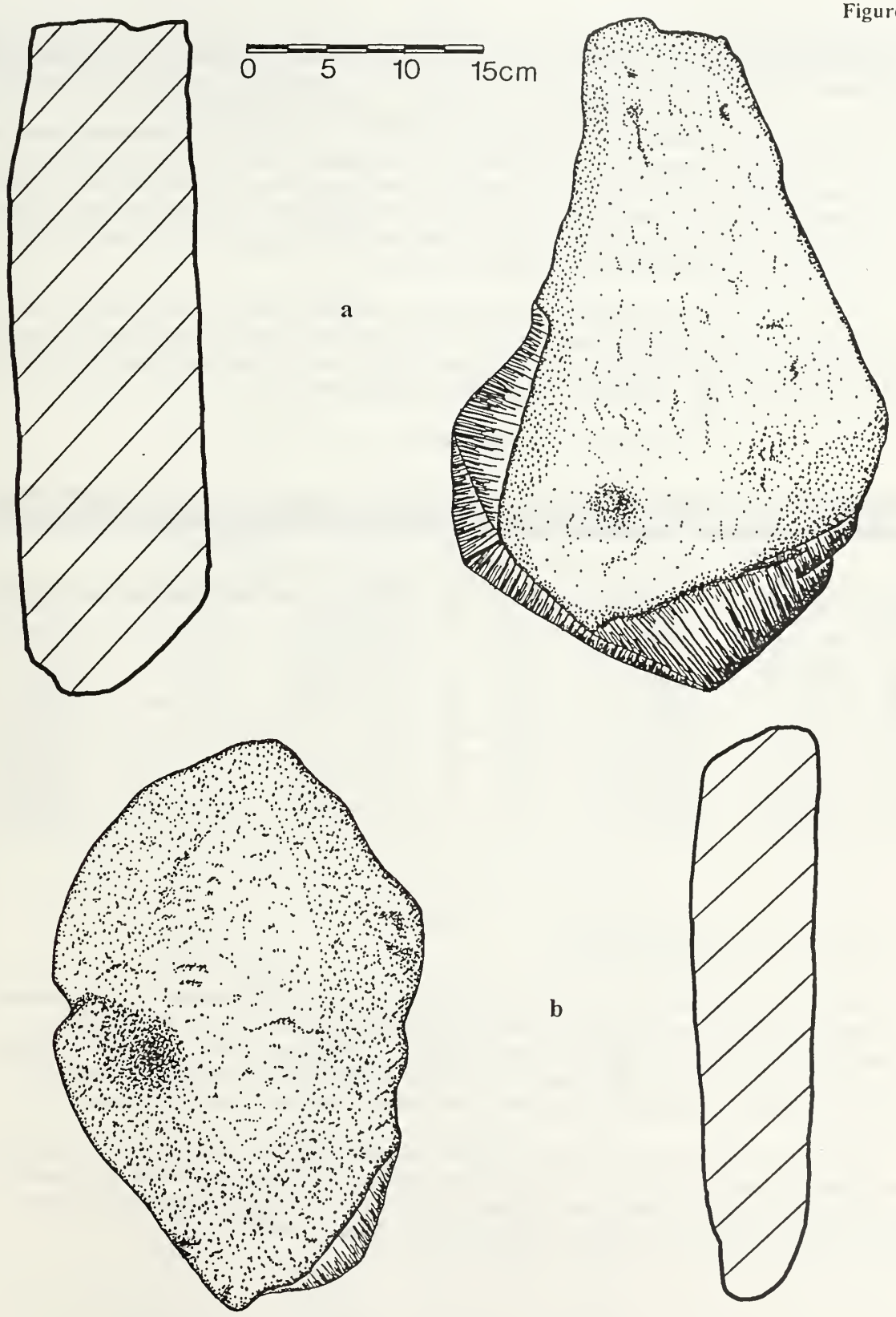
Metates a) 473-60, b) 473-64 from CA-TEH-1556 (Pipevine Rockshelter)

Figure 13



Metate (473-61) from CA-TEH-1556 (Pipevine Rockshelter)

Figure 14



Metates a) 473-62, b) 473-63 from CA-TEH-1556 (Pipevine Rockshelter)

Mano

A single andesite bifacial mano, with minimum or no shaping - fire broken and incomplete - was recovered. One aspect significant to the recovery is the location of the two halves in separate units. On half (454-1) was found in the 0-10 cm level of unit A, while the other fragment (454-19) was found in the top level of Unit B. Thus, each fragment was over 2 m distant from the other. This suggests some factor of disposal either through post-occupation movement or, more likely, a broad disposal of a rock oven following use. Such a practice has always been suspected in many California middens since fire cracked rock often appears generally scattered throughout much of the deposit and less often in a concentrated "feature" fashion. Measurements for this specimen are provided in Table 2. An attempt was made to recover blood residue on the specimens, but the results were unsuccessful (see Appendix 7). This could be the result of post-milling use in an oven.

Johnson's (1984:192-193) study of southern Cascade specimens suggests unshaped manos may be later than completely shaped specimens. While his sample is largely of unifacial manos, bifacial specimens also occur. No mention is made by Johnson of secondary use of manos as cooking stones, although such a practice is known in the Redding area at certain sites of the Shasta Complex (see Sundahl 1996:118-119).

Table 2

Milling Tool Characteristics

Catalog #	Location	Tool Type	Length (cm)	Width (cm)	Thickness (cm)	Material
455-22	B&B	Metate	22.5	20.0	12.0	Andesite
454-1	Blue Dick	Metate	50.0	33.0	15.0	Andesite
454-2	Blue Dick	Metate	43.0	30.0	15.0	Andesite
473-60	Pipevine	Metate	41.0	22.0	12.0	Andesite
473-61	Pipevine	Metate	58.0	42.0	8.0	Andesite
473-62	Pipevine	Metate	38.0	25.0	14.0	Andesite
473-63	Pipevine	Metate	37.0	27.0	8.0	Andesite
473-64	Pipevine	Metate	35.0	32.0	??	Andesite
454-19	Blue Dick	Mano	??	11.7	5.6	Andesite

FIRE CRACKED OR AFFECTED ROCK

The most ubiquitous ecofact found in many interior California midden deposits, especially in foothill settings, is the fire cracked and fire affected rock, usually cobble size. Such rock can provide a rough estimation of occupational use and intensity at living sites, although variation can be expected. For instance, is one dealing with an actual feature area, such as a rock oven, or a secondary dump area, house structure, or cemetery location? To what extent is living space constrained? Many other factors could also be discussed.

The fire affected and cracked rock recovery from the three rockshelters is presented in Table 3. Only those fragments larger than about 4 cm across were counted and weighed. The table clearly shows that overall these stones are relatively infrequent in B&B and Blue Dick rockshelters and in moderate quantities in Pipevine Rockshelter with a maximum of 54 fragments weighing 18.2 kg found in one level.

Table 3

Distribution of Fire Cracked and Affected Rock

B&B Rockshelter	Number	Weight (kg)
Unit A		
0-10 cm	3(?)	1.0 (?)
10-20 cm	0	0.0
20-30cm	0	0.0
Unit B		
0-10 cm	0	0.0
10-20 cm	0	0.0
20-30 cm	0	0.0
Unit C		
0-10 cm	0	0.0
TOTAL	**3**	**1.0**

Blue Dick Rockshelter	Number	Weight (kg)
Unit A		
0-10 cm	15	no weight
10-20 cm	6	no weight
20-30 cm	4	no weight
30-40 cm	0	0.0
Unit B		
0-10 cm	10	no weight
10-20 cm	0+	no weight
20-30 cm	0	0.0
TOTAL	**35+**	**0.0**

Pipevine Rockshelter	Number	Weight (kg)
Unit A		
0-10 cm	54	18.2
10-20 cm	28	8.2
20-30 cm	8	1.8
Unit B		
0-10 cm	9	5.0
10-20 cm	13	4.8
20-30 cm	9	3.6
Unit C		
0-10 cm	0	0.0
10-20 cm	7	2.3
20-30 cm	2	1.0
30-40 cm	0	0.0
TOTAL	**130**	**44.9**

Since such occurrence can provide relative degrees of "cooking oven" related activities, it is informative to compare the test sites' results with other regional sites. Similar size unit levels and recovery criteria aid in the comparisons.

Excavation in similar size units and levels along the Sacramento River just north of Red Bluff at a slightly larger rockshelter than those studied here (CA-TEH-1526) revealed a maximum of 22.0 kg, 24.3 kg, and 58.8 kg of fire cracked rock in three unit levels (Sundahl 1993:121). At nearby CA-TEH-810, an open camp, the numbers were less, with 8.5 kg, 14.7 kg and 20.6 kg of fire cracked rock maximum from three separate unit levels (Sundahl 1993:23). CA-TEH-1523, an open camp just up the Sacramento River, revealed a maximum of 36.3 kg of fire cracked rock in one level, but usually the content was in the 5-18 kg range (Sundahl 1993: 67). This is similar to Pipevine, although the extent and depth of the site is greater.

Two late prehistoric Valley villages along the Sacramento River in Redding, CA-SHA-47 and CA-SHA-236 (Vaughan 1992:79), provide further comparative data. Units at SHA-47 revealed a maximum of 19.5 kg and 30.9 kg of fire cracked rock per level, while nearby site CA-SHA-236 had fire cracked rock in four units with maximum weights by level of 15.4 kg, 21.3 kg, 25.0 kg and 26.3 kg. A late prehistoric Valley foothill site (CA-SHA-1588), on the other hand, has very high amounts of fire cracked rock per level, e.g. 32.0 kg 53.0 kg, and 71.9 kg (unpublished data on file with BLM, Redding).

Overall, the results not surprisingly suggest that B&B and Blue Dick rockshelters experienced relatively low levels of rock oven cooking and disposal. Pipevine Rockshelter exhibits moderate fire cracked rock disposal in one level near the surface but with a rapid drop-off thereafter.

It is interesting to note the relatively low numbers of fire-cracked rock from some of the riverine villages in both Tehama and Shasta counties, despite the local abundance of suitable rock. On the other hand, a neighboring Tehama County rockshelter and a foothill site near Redding have considerably higher amounts. Part of this factor has to deal with sampling in probable rock oven dump areas, or at the mouth of the rockshelters and village edge. Part has to do with the single fact these features were used more, or more often at certain sites. Large open middens along the river have fewer rocks per unit volume, but these sites are larger, with possible greater buildup of deposit at a more rapid rate through both cultural and natural (e.g. flood deposit) factors.

Overall, it would appear that there was relatively little rock oven use at B&B and Blue Dick rockshelters, and more, but still relatively limited use at Pipevine rockshelter. Foothill and certain rockshelter settings appear to have higher yields than Valley sites, but part of this reason is more concentrated and confined activities in a shelter, although part may also be do to the processing of different food products, or more frequent preparation of these foods.

FLAKED STONE ARTIFACTS

Representing substantial, and sometimes the largest single category of artifacts recovered from sites CA-TEH-1554, -1555, and -1556, the flaked stone artifacts represent 22.2%, 78.5%, and 71.4% respectively, of the total cultural assemblages. The objectives for the lithic analysis of these assemblages were: 1) to identify and describe the lithic technologies exhibited at each site; 2) to define and evaluate the typological composition of each collection through assessment of their respective temporal and morphological aspects; and 3) to ascertain site function including the duration and/or frequency of site occupation.

The final objective was, in retrospect, overly ambitious given the limited nature of the assemblages and the lack of well-defined depositional contexts within the sites.

Archaeological research in the vicinity of CA-TEH-1554,-1555 and -1556 has been limited to a few sites: TEH-1 (Kingsley Cave), TEH-193 (Payne Cave), TEH-1432 (Spider Rockshelter), TEH-1490, and TEH-1488 (New

Creek Site), and TEH-563 and FS 05-06-51-40 in the Ishi Wilderness. Although most of the sites are adequately documented, only the most recently published sites (TEH-563, FS 05-06-51-40, TEH-1432, -1490 and -1488) contain descriptively detailed technological analyses of the retrieved lithic assemblages. The older studies focus on the typological and morphological attributes of specified tools, such as projectile points or cores, extracting comparisons within and among collections on the basis of inferred functional categories. Lithic debitage, if acknowledged at all, is only separated by raw material, quantified, and weighed. Although typological comparisons are demonstrably valid in that they may provide us with chronological sequences based on artifacts known to be temporal markers, function does not necessarily follow form (Tringham et al. 1974:174). Thus, a technological focus on both formal tools and their resultant by-products may efficaciously provide an understanding of the reduction strategies operative at the site. Nilsson relates, "...it is only when the overall core reduction/tool production continuum has been recognized that the processes involved in flaked stone tool manufacture can be fully understood" (1988:2).

This chapter will integrate a technological and typological analysis of the flaked stone assemblages from CA-TEH-1554, -1555, and -1556. This holistic combination should produce data concerning both general and specific cultural patterning with regard to intra- and inter-site relationships.

Methodology

The lithic analyses for all three sites were guided by two areas of investigation: typological and technological. The former assigned artifacts into specific categories on the basis of morphological aspects. This process initially segregated artifacts into gross categories and then eventually into subtype categories (e.g., bifaces and projectile points). This typological assessment of an artifact "assists in identifying the range of variation within a collection, provides a way to compare artifact types within and between assemblages, and creates distinct categories from which technological analyses can proceed" (Nilsson 1988:3).

The second investigative method for this examination focused on attribute analysis (Binford and Quimby 1963; Frison and Bradley 1980; Greenway and Nilsson 1986). This method involves describing varied sets of technological attribute categories for each artifact identified during the earlier typological assessment. The examination of these discrete attributes then supplies data for our understanding of the core reduction/tool production continuum.

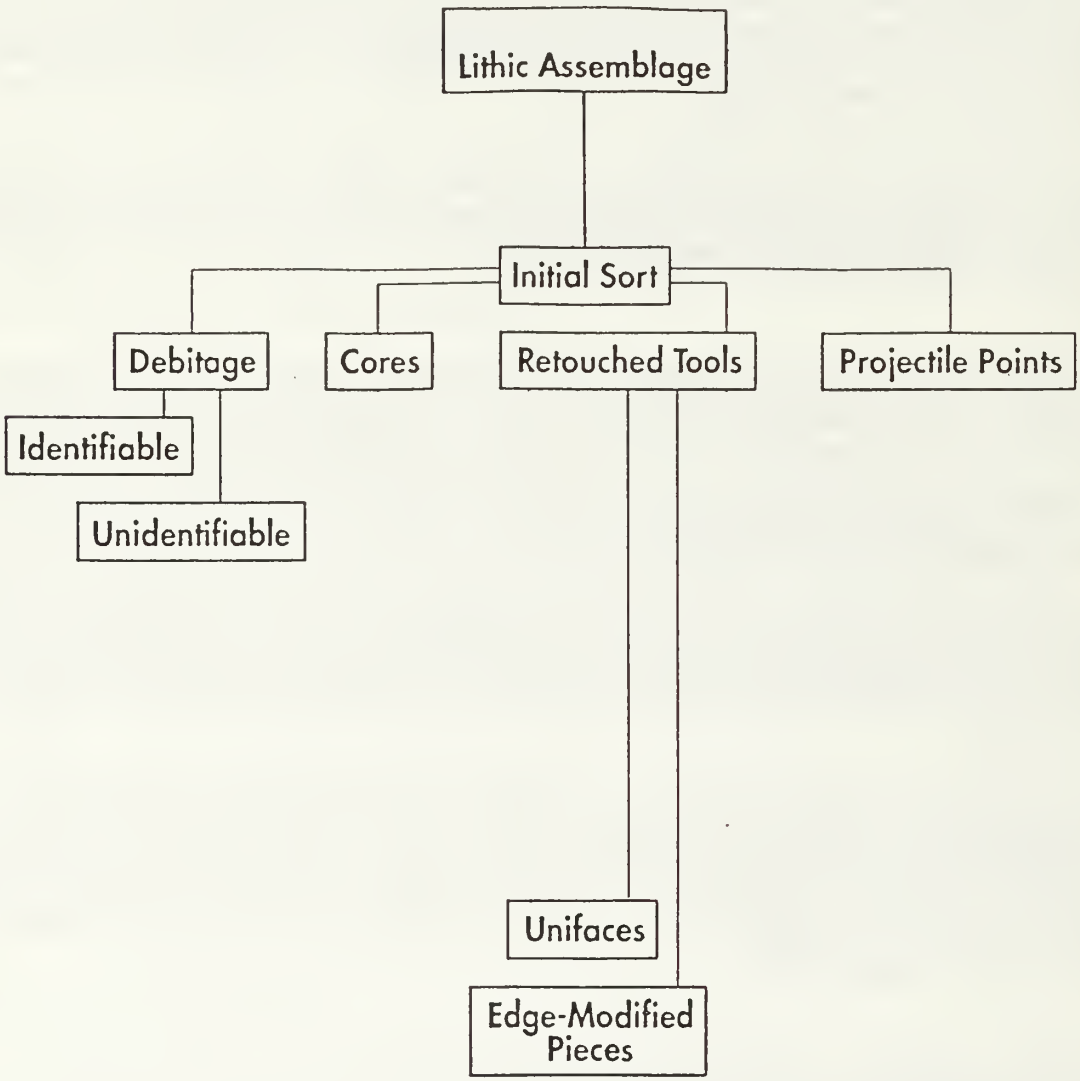
The lithic assemblages were examined by the junior author in detail. Each site was sorted, independently, on the basis of morphological characteristics into four categories: debitage, cores, retouched tools, and projectile points (refer to Figure 15). The lithic tools were grouped according to inferred functional class (e.g., edge-modified pieces) based on macroscopic characteristics. All debitage was grouped, quantified, and further classified according to the reduction stage assigned by the definitional criteria developed by Crabtree (1982) and Flenniken (1987), and adapted by Nilsson (1988).

The results of these analyses are presented, independently by site, in four sections:

1) Debitage: identifiable and unidentifiable,
2) Cores,
3) Retouched Tools: edge-modified piece and uniface and,
4) Projectile Point

The four sections are defined below. Additionally, Table 4 delineates the discrete technological attributes generated for each individual artifact group at all three sites. Refer also to artifact classification (morphology), definitional criteria, and the glossary of lithic terminology provided in Appendix 5. The raw data generated for identifiable and unidentifiable debitage from all sites are found in Appendix 6.

Figure 15



Schematic of Methodology

Table 4

Applied Attributes for the Flaked Stone Assemblage

ATTRIBUTE	Debitage		Cores	Retouched Tools		Projectile Point
	Ident	Unident		EdgeMod	Uniface	
Unit	X	X	X	X	X	X
Level/Depth	X	X	X	X	X	X
Material	X	X	X	X	X	X
Condition	X					X
Type/Stage	X			X	X	X
Weight	X	X	X		X	X
Grid Size	X	X	X	X	X	
Area of Modification				X		
Shape of Retouch				X		
Flaking Pattern/Retouch Type				X	X	
No. of Edges				X		
Edge Angle				X		
Shape/Plan View			X		X	X
No. of Flake Scars			X			
Length						X
Width						X
Thickness						X

CA-TEH-1554 (B&B Rockshelter)

Table 5 demonstrates the breakdown of flaked stone artifact categories by material type at CA-TEH-1554.

Table 5

CA-TEH-1554: Flaked Stone Artifacts By Raw Material

Artifact Type	Obsidian		CCS		Basalt		Row Total	
	n	%	n	%	n	%	n	%
Debitage:								
Identifiable	--	--	1	5.9	16	94.1	17	100.0
Unidentifiable	--	--	--	--	9	100.0	9	100.0
Cores	--	--	--	--	--	--	--	--
Edge-Modified Piece	--	--	--	--	--	--	--	--
Uniface	--	--	--	--	--	--	--	--
Projectile Point	--	--	--	--	--	--	--	--
TOTALS	--	--	1	3.8	25	96.2	26	100.0

DEBITAGE

Two material types, cryptocrystalline silicates (hereafter referred to as "ccs") and basaltic types, were recovered from site CA-TEH-1554. The latter material varies from very fine-to-fine-grained basaltic rock types and is not only present at CA-TEH-1554, but represented at the other two rockshelter sites as well.

Identifiable Debitage

Identifiable debitage is the largest single category of this extremely sparse lithic assemblage. Debitage is considered to be identifiable when flakes exhibit complete platforms and terminations, and when greater than 50% of their margins are intact. The collection consists of 17 identifiable pieces, or 65.4% of the total lithic assemblage. Table 6 shows identifiable debitage frequencies by raw materials and type.

CCS

A single primary flake of ccs (5.9% of the identifiable debitage) was recovered from the 10-20cm level. The flake maintains a grid size of 16mm and is comparable in size to much of the basalt debitage. The black flaked stone is fair in quality, exhibiting sporadic inclusions and phenocrystic veins. Lacking a glazed or waxy patina, this toolstone does not appear to be thermally altered as is often the case in ccs reduction strategies.

Basalt

Local fine-grained basalt materials (n=7, 87.5%) comprise the majority of the identifiable debitage. Water-smoothed cobbles and other local toolstones are predominately basalt and were probably collected in and around a nearby waterway. Most of these flakes maintain a dorsal surface with 100% cortex. This group of artifacts typifies primary reduction strategies and obviously suggests the occupants' close proximity to the raw material source (Bayham et al. 1986:435). Other flake types represented are: alternate, edge preparation, angular shatter, and one bipolar flake.

Table 6

CA-TEH-1554: Identifiable Debitage Frequencies By Raw Material and Type

Debitage Type	Obsidian		CCS		Basalt		Row Total	
	n	%	n	%	n	%	n	%
PRI	--	--	1	12.5	7	87.5	8	100.0
ECR	--	--	--	--	--	--	--	--
LCR	--	--	--	--	--	--	--	--
EBTF	--	--	--	--	--	--	--	--
EPRES	--	--	--	--	--	--	--	--
ALT	--	--	--	--	2	100.0	2	100.0
EPREP	--	--	--	--	2	100.0	2	100.0
SHATT	--	--	--	--	4	100.0	4	100.0
BIP	--	--	--	--	1	100.0	1	100.0
TOTALS	--	--	1	5.9	16	94.1	17	100.0

KEY:
PRI = primary reduction flake
ECR = early core reduction flake
LCR = late core reduction flake
EBTF = early biface thinning flake
EPRES = early pressure flake
ALT = alternate flake
EPREP = edge preparation flake
SHATT = angular shatter
BIP = bipolar flake

Unidentifiable Debitage

Nine pieces (34.6% of the total lithic assemblage) of basaltic flakes were recorded as "unidentifiable". A majority of these flakes have crushed and/or broken platforms and they often display several arrises on their dorsal surfaces. The average grid size of these flakes is 30mm (range 10-60mm).

Site Lithic Summary

The lithic assemblage from CA-TEH-1554, consisting solely of debitage, suggests activities at the site were directed towards the primary reduction of local basaltic materials. Minimal evidence for the more intensive use of this toolstone includes alternate flakes, angular shatter, and one bipolar flake.

CA-TEH-1555 (Blue Dick Rockshelter)

A larger lithic assemblage was obtained at CA-TEH-1555 than from CA-TEH-1554. In addition to debitage, two cores have been recovered. Refer to Table 7 for flaked stone artifact categories at CA-TEH-1555 by material type.

DEBITAGE

Both obsidian toolstone and basaltic materials are represented in the debitage collection at CA-TEH-1555. Visual sourcing suggests the obsidian material has been most probably imported from the Tuscan and perhaps the Grasshopper Flat/Lost Iron Wells/Red Switchback (GF/LIW/RS) glass sources (see Appendix 7). Flakes of ccs are absent from the collection.

Table 7

CA-TEH-1555: Flaked Stone Artifacts By Raw Material

Artifact Type	Obsidian		CCS		Basalt		Row Total	
	n	%	n	%	n	%	n	%
Debitage:								
Identifiable	19	21.8		—	68	78.2	87	100.0
Unidentifiable	8	22.9		--	27	77.1	35	100.0
Cores	--	--		--	2	100.0	2	100.0
Edge-Modified Piece	--	--		--	--	--	--	--
Uniface --	--		--	--	--	--	--	
Projectile Point	--	--		--	--	--	--	--
TOTALS	27	21.8		--	97	78.2	124	100.0

Identifiable Debitage

Identifiable debitage is again the largest single category of the lithic assemblage. The collection consists of 87 identifiable pieces, or 70.2% of the total lithic assemblage. Table 8 shows identifiable debitage frequencies by raw material and type.

Table 8

CA-TEH-1555: Identifiable Debitage Frequencies By Raw Material and Type

Debitage Type	Obsidian		CCS		Basalt		Row Total	
	n	%	n	%	n	%	n	%
PRI	1	16.7	--	--	5	83.3	6	100.0
ECR	3	6.5	--	--	43	93.5	46	100.0
LCR	7	35.0	--	--	13	65.0	20	100.0
EBTF	5	62.5	--	--	3	37.5	8	100.0
EPRES	2	100.0	--	--	--	--	2	100.0
ALT	--	--	--	--	--	--	--	--
EPREP	1	33.4	--	--	2	66.6	3	100.0
SHATT	--	--	--	--	2	100.0	2	100.0
BIP	--	--	--	--	--	--	--	--
TOTALS	**19**	**21.8**	--	--	**68**	**78.2**	**87**	**100.0**

KEY:
PRI = primary reduction flake
ECR = early core reduction flake
LCR = late core reduction flake
EBTF = early biface thinning flake
EPRES = early pressure flake
ALT = alternate flake
EPREP = edge preparation flake
SHATT = angular shatter
BIP = bipolar flake

Obsidian

Obsidian constitutes 21.8% (n=19) of the identifiable debitage. A few limited flakes display remnant cortex, and yet much of this debitage is indicative of late core (n=7, 35.0%) and early bifacial thinning (n=5, 62.5%) reduction strategies. Notable is the paucity of primary/initial reduction flakes.

Pressure flakes and one edge preparation flake recovered from site CA-TEH-1555 are of obsidian. Also noted is the relatively small size of the obsidian debitage (grid size range: 6 to 24mm, mean = 13mm). The measurements, however, may be a reflection more of the original size of the parent material, rather than of the type of reduction strategy utilized.

Basalt

The remaining 78.2% of identifiable debitage (n=68) is comprised of fine-grained basalt. Although several pieces (n=5) maintain a dorsal surface with 100% cortex, much of the basalt debitage suggests early to late core reduction. Other flake types represented are early bifacial thinning and edge preparation flakes, and angular shatter.

Unidentifiable Debitage

Unidentifiable debitage was earlier defined as representing those flakes with a missing and/or broken platform which renders the platform indistinguishable. In this analysis, a flake is also considered unidentifiable when it is missing greater than 50% of its terminal end. Thirty-five pieces (28.2% of the total lithic assemblage) were recorded as "unidentifiable". Much of the basaltic material is angular, blocky, and lacks a discernible platform. Unidentifiable debitage of obsidian often elicits numerous arrises with crushed platforms. Additionally, the

apparent absence of identifiable bipolar flake types may indeed be remnant portions now subsumed into this unidentifiable category. The size range of all unidentifiable materials is 4-48mm (mean = 14.5mm).

Debitage Discussion

It is apparent from the prevalence of early to late core debitage types and the close proximity to Antelope and Salt creeks and cobbles in local volcanic beds that lithic materials, with the exception of obsidian, have been obtained locally. Although imported obsidian constitutes only 21.8% of the identifiable debitage at the site, Tuscan obsidian (visually sourced) clearly dominates this portion of the collection (see Appendix 7).

The Tuscan obsidian source, which occurs locally in the Paynes and Inks Creek vicinity, is notably the closest glass source although it also occurs more distant (Hamusek McGann 1993). Geographically, the Kelly Mountain source is also near, yet it is poor in quality and displays numerous phenocrystic inclusions. The latter may be a factor in the apparent absence of this material type at the site. The final source, GF/LIW/RS, appears to be minimally represented.

CORES

Two cores, or 1.6% of the lithic assemblage, were recovered from site CA-TEH-1555 (refer to Table 9 below). Both cores, fashioned from basaltic material, are multiple platform cores. Both were reduced through free-hand percussion and one specimen (454-5) displays the utilization of platform preparation techniques (grinding and/or abrading) often used in core reduction.

Multiple Platform Cores

So designated because of their unpatterned striking platforms, this core type demonstrates what appears to be a non-systematic removal of flakes. Specimen 454-5 exhibits six negative flake scars with approximately 25% residual cortex. Heavy platform preparation located near this residual cortical area appears to be indicative of exhaustive utilization of this toolstone.

The remnant of a larger water-smoothed cobble, core specimen 454-23, displays 10 negative flake scars. Both faces exhibit a high degree of remnant cortex. Most notable is the bifacial end-flaking produced by freehand percussion of the cobble.

Table 9

CA-TEH-1555: SELECTED CORE ATTRIBUTES

CAT.#	UNIT/LEVEL	CORE TYPE	WEIGHT	GRID SIZE
454-5	A 10-20 cm	Multiple platform	26.2 gm	48 mm
454-23	B 10-20 cm	Multiple platform	283.6 gm	89 mm

Core Discussion

It is difficult to assess the importance of cores at site CA-TEH-1555 due to the limited number of specimens. However, with regard to the number of cores present at the site, Shackley suggests,

> ..assuming equal site-formation processes and minimum scavenging, the proportion of cores and debitage should be linear, in that a high frequency of debitage should be reflected in a relatively large number of cores. When the ratio of cores to debitage is low, the debitage may be the result

of alternative technological processes such as facial tool maintenance and rejuvenation (Henry et al. 1976, Patterson and Sollberger 1978, Shackley in Bayham et al. 1986:121).

Limited comparative evaluations can be made with local intersite debitage types based on the direct frequency ratio of cores to debitage. CA-TEH-1490, reported to be a site involved in "...activities associated with the mid to final stages of projectile manufacturing, refurbishing of points or bifaces, and (the) reduction of large biface blanks..." (Hamusek 1988:59), retains a ratio of 1:380 (cores to debitage). On the other hand, at CA-TEH-1555, the ratio of cores to debitage is 1:61. The latter ratio suggests that even with the paucity of primary reduction flakes of basaltic toolstone, materials were probably locally accessible and reduced on site. The lack of obsidian cores, however, argues for off-site primary reduction strategies for that material.

Site Lithic Summary

The lithic assemblage from CA-TEH-1555 forms the largest class of cultural materials retrieved from the site. These artifacts, which include identifiable and unidentifiable debitage and two cores, were fashioned of both imported (obsidian) and local basaltic materials. Local materials appear to have been generously and expeditiously reduced and the frequent "testability" of these materials argues for the possibility of a more than temporary seasonal campsite (cf. Shackley in Bayham et al. 1986).

Reduction strategies strongly reflect percussion techniques in early to intermediate stages, with some evidence of early bifacial reduction. (Whereas the bifacial reduction of obsidian at many sites is commonplace, evidence for the bifacial reduction of basalt artifacts is quite rare. The latter, however, is not only noted at CA-TEH-1555 but at other local sites, CA-TEH-1488 [Nilsson et al. 1991:60] and CA-TEH-563 and FS 05-06-51-40 [Bevill et al. 1996:50, 95]). Smaller pieces of obsidian debitage (early stage pressure flakes and edge preparation) suggest some formal tool formation and/or edge rejuvenation processes were taking place at the site as well.

CA-TEH-1556 (Pipevine Rockshelter)

The largest lithic assemblage of the three Rockshelter sites is from CA-TEH-1556 and consists of 274 artifacts. Pipevine Rockshelter is, additionally, the most varied by material type: obsidian, ccs and basaltic materials are present. The collection consists of debitage, cores, an edge-modified piece, one (1) uniface, and a projectile point. Refer to Table 10 for flaked stone artifact categories at CA-TEH-1556 by raw material type.

Table 10

CA-TEH-1556: Flaked Stone Artifacts By Raw Material

Artifact Type	Obsidian		CCS		Basalt		Row Total	
	n	%	n	%	n	%	n	%
Debitage:								
Identifiable	41	22.7	--	--	140	77.3	181	100.0
Unidentifiable	4	5.1	1	1.3	74	93.6	79	100.0
Cores	--	--	--	--	11	100.0	11	100.0
Edge-Modified Piece	--	--	--	--	1	100.0	1	100.0
Uniface	--	--	--	--	1	100.0	1	100.0
Projectile Point	1	100.0	--	--	--	--	--	--
TOTALS	**46**	**16.8**	**1**	**0.4**	**227**	**82.8**	**274**	**100.0**

DEBITAGE

Obsidian toolstone and basaltic materials are, together, the predominant flaked stone in the debitage collection at CA-TEH-1556. One piece of unidentifiable detritus of ccs is also present. As with CA-TEH-1555, visual sourcing suggests the obsidian material has been most probably imported from the Tuscan glass source. The Grasshopper Flat/Lost Iron Wells/Red Switchback (GF/LIW/RS) glass source is also probably represented based on visual examinations. One piece of probable Kelly Mountain obsidian was noted during the site recording but was not recovered.

Identifiable Debitage

Identifiable debitage is the largest single category of the lithic assemblage (n= 181, 66.1% of the total lithic assemblage). Table 11 presents identifiable debitage frequencies by raw material and type.

Table 11

CA-TEH-1556: Identifiable Debitage Frequencies By Raw Material and Type

Debitage Type	Obsidian		CCS		Basalt		Row Total	
	n	%	n	%	n	%	n	%
PRI	11	50.0	--	--	11	50.0	22	100.0
ECR	9	8.7	--	--	95	91.3	104	100.0
LCR	9	30.0	--	--	21	70.0	30	100.0
EBTF	5	38.5	--	--	8	61.5	13	100.0
EPRES	2	100.0	--	--	--	--	2	100.0
ALT	1	50.0	--	--	1	50.0	2	100.0
EPREP	2	100.0	--	--	--	--	2	100.0
SHATT	--	--	--	--	4	100.0	4	100.0
BIP	2	100.0	--	--	--	--	2	100.0
TOTALS	41	22.7	--	--	140	77.3	181	100.0

KEY:
PRI = primary reduction flake
ECR = early core reduction flake
LCR = late core reduction flake
EBTF = early biface thinning flake
EPRES = early pressure flake
ALT = alternate flake
EPREP = edge preparation flake
SHATT = angular shatter
BIP = bipolar flake

Obsidian

Imported obsidian constitutes 22.7% (n=41) of the identifiable debitage. The majority of flakes display remnant cortex (primary reduction [n=11, 26.8%]), and much of this detritus is indicative of early core (n=9, 22.0%), late core (n=9, 22.0%) and early bifacial thinning (n=5, 12.2%) reduction strategies. Obsidian in this assemblage has the most variable range of flake types of the toolstones recovered from the site. Early pressure flakes, edge preparation flakes, and two bipolar flakes recovered from site CA-TEH-1555 are also obsidian.

Similar to CA-TEH-1555, site CA-TEH-1556 also maintains a relatively small size of obsidian debitage (grid size range: 6 to 24mm, mean = 14.5). As reported earlier, the type of reduction strategy utilized for this toolstone may be related to the original size of the parent material and may often account for evidence of bipolared remnants. In particular, Tuscan obsidian nodules are known to be an average 7 to 10 cm in diameter (although they may vary in size from 3 to 13 cm) and are generally thought to be reduced by splitting the small cobble/nodule in a bipolar

fashion (Sundahl 1989:personal communication). It is probable that resource stress on the Tuscan obsidian source may have placed limitations on procurement of the larger cobbles, especially in later prehistoric periods (Sundahl 1989: personal communication) and this could account for the small debitage size found in some levels at CA-TEH-1556. As likely, however, is the fact that obsidian nodules observed in the region near Paynes and Inks Creek range from 0.5 cm to 7.0 cm in diameter (Hamusek McGann 1993:71-72).

Basalt

More than three-quarters of the identifiable debitage at CA-TEH-1556 is basaltic flaked stone (n=140, 77.3%). Many of the specimens suggest activities which center chiefly on the primary decortication/initial reduction of water-smoothed cobbles. This group of artifacts predominantly typifies initial, early-to-late core reduction, and some early bifacial thinning (n=8, 5.7%).

Unidentifiable Debitage

Seventy-nine specimens (28.8% of the total lithic assemblage) are considered to be unidentifiable at site CA-TEH-1556. The basaltic flakes are often characterized by broken or crushed cortical platforms. Unidentifiable debitage of obsidian (n=4) and ccs (n=1) lacks platforms. Additionally, the size range of obsidian and ccs materials (6-14mm, mean=9.6mm) are generally smaller than basaltic debitage.

Table 12

CA-TEH-1556: Identifiable Debitage By Raw Material, Unit and Level

LEVEL/ UNIT	OBSIDIAN n	OBSIDIAN %	CCS n	CCS %	BASALT n	BASALT %	ROW TOTAL n	ROW TOTAL %
Unit A								
0-10 cm	4	11.4	--	--	31	86.6	35	100.0
10-20 cm	3	15.0	--	--	17	85.0	20	100.0
20-30 cm	--	--	--	--	8	100.0	8	100.0
30-40 cm	2	14.3	--	--	12	85.7	14	100.0
TOTALS	9	11.7	--	--	68	88.3	77	100.0
Unit B (* combined w/ flotation)								
0-10 cm	23	50.0	--	--	23	50.0	46	100.0
10-20 cm *	9	45.0	--	--	11	55.0	20	100.0
20-30	--	--	--	--	6	100.0	6	100.0
TOTALS	32	44.4	--	--	40	55.6	72	100.0
Unit C								
0-10 cm	--	--	--	--	2	100.0	2	100.0
10-20 cm	--	--	--	--	5	100.0	5	100.0
20-30 cm	--	--	--	--	5	100.0	5	100.0
30-40 cm	--	--	--	--	2	100.0	2	100.0
TOTALS	--	--	--	--	14	100.0	14	100.0
Rodent Mound								
Surface	--	--	--	--	18	100.0	18	100.0
TOTALS	--	--	--	--	18	100.0	18	100.0

Debitage Discussion

Materials utilized at CA-TEH-1556 appear to have a close relationship with the local stream and volcanically redeposited cobbles, as well as some dependence on somewhat nearby obsidian materials on the east side of the upper Sacramento Valley. While site deposition appears limited to about 40 cm, and total numerical data sets are comparatively small, the debitage from Pipevine Rockshelter is the largest of the debitage collections amongst the three sites. Further data (refer to Table 12) from all units and all levels at CA-TEH-1556 suggest no diachronic variation in the utilization of material type. As noted in Table 12, the local, generally larger, raw materials are greatly emphasized and predominate in all levels (the one exception is the 10-20cm flotation sample in which obsidian microdebitage is appropriately reflected). Generally, obsidian detritus (identifiable and unidentifiable) plays a fairly static role within the midden at CA-TEH-1556.

The final raw material type, ccs (unidentifiable), occurs in limited quantity. The source area for this toolstone is unknown. Noting the minimal use of ccs at nearby site CA-TEH-1488, Nilsson et al. suggest that "...either the procurement area is not too distant, or that small, easily transportable pieces were brought to the site for reduction" (1991:58).

CORES

Eleven cores of various basaltic materials (4.0% of the lithic assemblage), were recovered from the surface to 10 cm in depth at site CA-TEH-1556 (refer to Table 13 below, Figure 16). The cores were reduced through free-hand percussion, yet one specimen (#473-7) displays the utilization of platform preparation techniques (grinding and/or abrading) often used in core reduction. Another artifact, #473-30, is unique in that flakes have been removed in one direction from one platform area. All others appear to be expeditiously reduced in random fashion.

Table 13

CA-TEH-1556: Selected Core Attributes

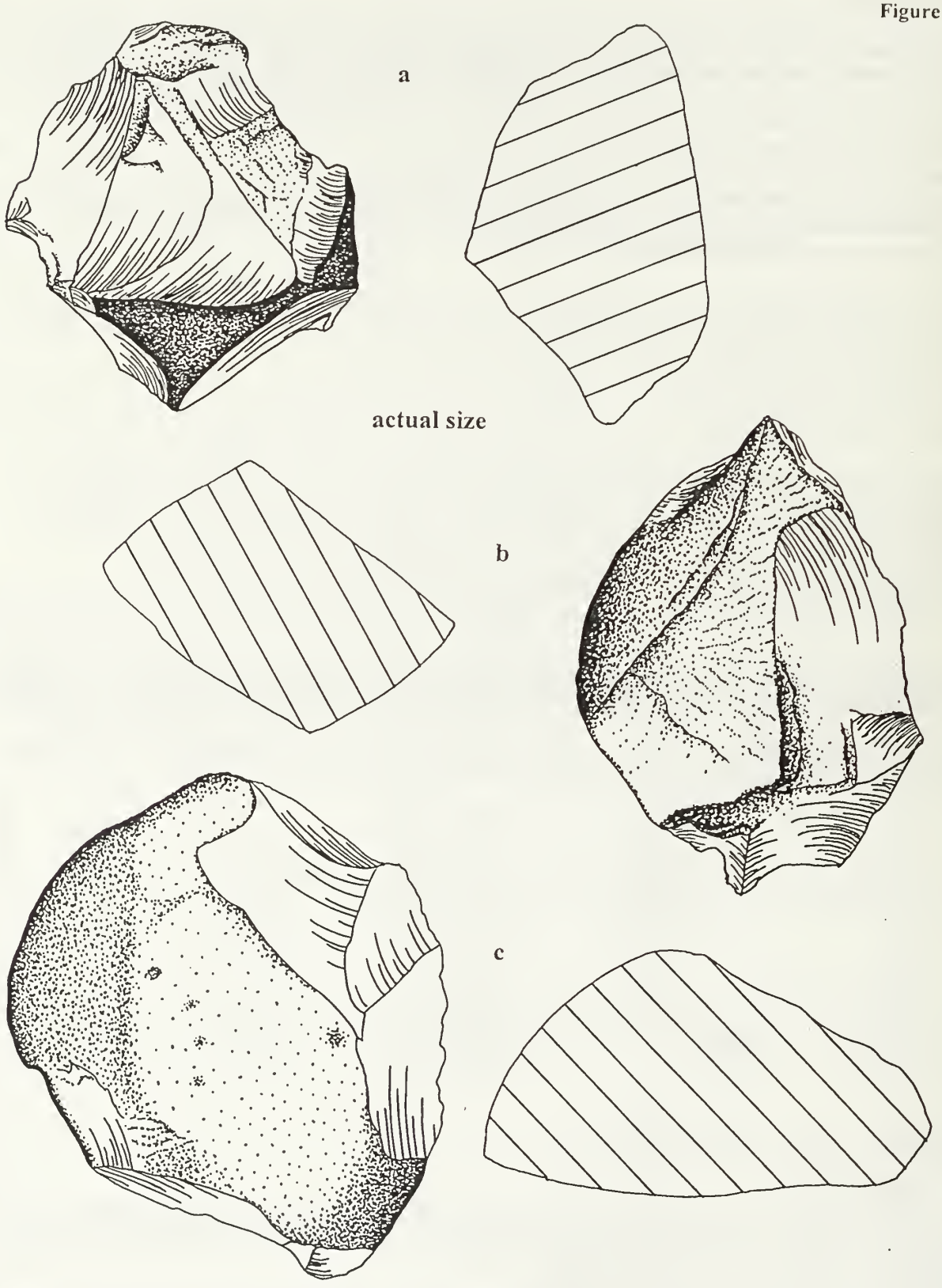
CAT.#	UNIT/LEVEL		CORE TYPE	WEIGHT	GRID SIZE
473-2	A	0-10 cm	Multiple platform	103.6 gm	65 mm
473-3	A	0-10 cm	Multiple platform	71.0 gm	55 mm
473-4	A	0-10 cm	Multiple platform	156.0 gm	80 mm
473-5	A	0-10 cm	Multiple platform	185.1 gm	75 mm
473-6	A	0-10 cm	Multiple platform	261.1 gm	85 mm
473-7	A	0-10 cm	Multiple platform	145.3 gm	70 mm
473-9	A	0-10 cm	*Multiple platform	>300.0 gm	81 mm
473-30	B	0-10 cm	Single platform	>300.0 gm	97 mm
473-53	Surface		*Multiple platform	232.1 gm	80 mm
473-54	Surface		Multiple platform	177.5 gm	63 mm
473-55	Surface		Multiple platform	>300.0 gm	82 mm

* w/ bifacial end-flaking and/or modification

Multiple Platform Cores

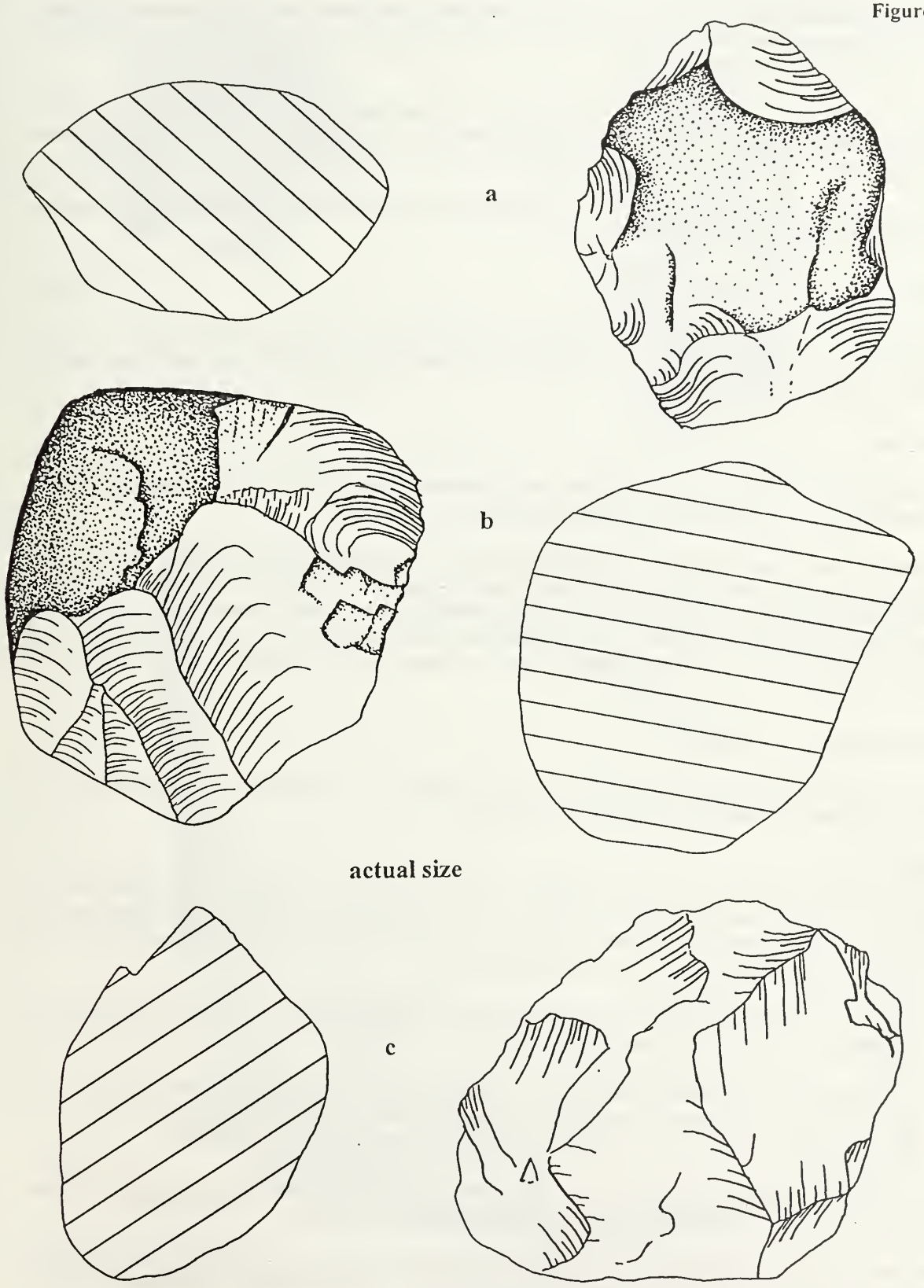
Ten cores, ranging in size from 55-85 mm (mean = 73.6 mm), are here defined by their unpatterned, randomly oriented platform areas. This core type demonstrates what appears to be a non-systematic removal of flakes with a variable of 6-11 negative flake scars on each artifact.

Figure 16



Multiple Platform Cores a) 473-2, b) 473-4, c) 473-6 from CA-TEH-1556 (Pipevine Rockshelter)

Figure 17



Multiple Platform Cores a) 473-7, b) 473-9, c) 473-53 from CA-TEH-1556 (Pipevine Rockshelter)

These cores are predominantly plano-convex or convexo triangular in plan view. Platform preparation appears to be absent with the exception of the above mentioned specimen (#473-7, Figure 17). Future use-wear studies may determine it to have been a utilized core tool.

The platform orientation of two cores (#473-9,-53, Figure 17), although random in perspective, have several flake scars removed from opposing/adjacent faces to form a bifacial region on the core. It may be possible that the maker was attempting, with further reduction, to create a biface or some other edge-flaked tool.

Residual cortex on all cores ranges from 10-75%. Much of the cortex is smooth which suggests the parent material was most likely water-worn cobbles.

Single Platform Core

Artifact #473-30, the only core from Unit B, is biconvex in form. This core, which retains 25% cortex, displays four negative flake scars which originate from a single unidirectional platform. Notably, this core is the largest of the specimens recovered from CA-TEH-1556.

Core Discussion

Of the 11 recovered core specimens, only one demonstrates systematic removal of flakes from a singular platform. All other cores appear to be expediently reduced through freehand percussion.

Based on the above mentioned hypothesis of Shackley (Bayham et al. 1986), the direct frequency ratio of cores to debitage at site CA-TEH-1556 (1:24), is more closely related to that of CA-TEH-1555 (1:61), than that of CA-TEH-1490 (1:380). Whereas the latter site is said to have occupants that "...were refurbishing or finishing the reduction of large flakes, blanks or bifaces- a temporary hunting camp occupied yearly (Hamusek 1988:69); sites CA-TEH-1555, -1556 proffer initial reduction strategies that are suggestive of less logistical mobility and, perhaps, opportunistic residency.

RETOUCHED TOOLS

This grouping collectively includes two specimens (one edge-modified piece and one uniface) which are 0.7% of the total lithic assemblage. Both are fashioned of basaltic material.

Edge-Modified Piece

One very large (len. =111.9mm, wid. = 155.3mm, thck. = 29.8mm, wght. = >300.0gm) late core reduction flake was recovered from the 0-10cm level in Unit A (Figure 18). In order to strike or knap such a large flake from the parent material, extreme percussive force would have been applied. Indeed, a bulbar flake scar, demonstrating this force, is present on the dorsal surface of this large modified flake.

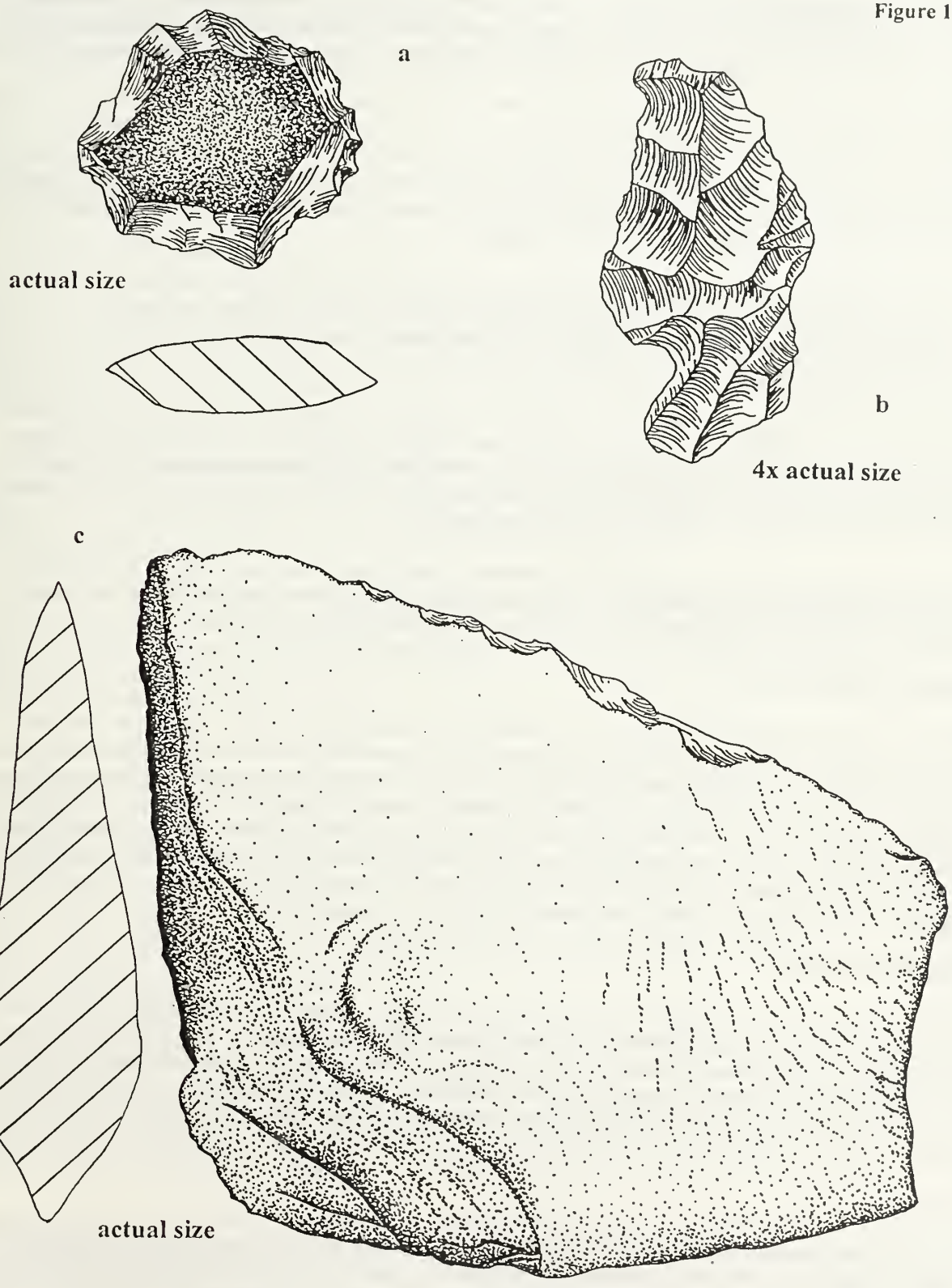
Often the preferred location of retouch for edge modified pieces is the margins or lateral areas, yet artifact #473-8 has been modified on its' distal end. In fact, Nilsson states that,

> ...the modification of a lateral edge provides for a longer working surface than would end retouch and, depending on the intended function of the tool, might give speed and efficiency to a task where a shorter (i.e. smaller) area of modification would be less appropriate (1988:28).

It could be that the actual larger/wider size of this artifact enabled its' creator to utilize it in chopper-like fashion, without regard or concern for a typical elongated "working surface" (the margin).

The edge angle for this edge-modified piece is 50 degrees. Replicative experiments by Wilmsen (1974:91-92) on edge angles of 50 to 75 degrees suggest that these particular angles would be most effective in absorbing the heavy shear stress generated in cutting, scraping, or shaping bone or wood.

Figure 18



Uniface a) 473-40, Projectile Point b) 473-10, Edge-Modified Piece c) 473-8

from CA-TEH-1556 (Pipevine Rockshelter)

Hayden (1979) concludes that unifacial polish and/or scalar modification most frequently connotes scraping, whereas bifacial modification generally indicates cutting. Artifact #473-8, therefore, with it's minimal bifacially flaked and ground edge, and a straight shape of retouch, most probably was utilized in a cleaver/chopper-like manner.

Uniface

Unifaces, as mentioned earlier, are formally shaped artifacts with invasive retouch (at least 50% of the worked face) that extends across one face of the specimen. More specifically and functionally, specimen #473-40 (Figure 18) of fine-grained basalt, may be classified as a unifacial "scraper".

> (These tools are) plano-convex flakes or blades that have been steeply retouched along one or more margin, giving the edge or edges an excurvate outline. The modification is generally pronounced, high-angled (45-90 degrees), and invades onto the dorsal surface of the blank (Nilsson 1988:24).

It is noteworthy here to suggest that other sites with a similar collection of debitage and cores often possess, by relative percentage, a higher incidence of edge-modified pieces, unifaces and bifaces (the latter being totally absent from the recovered collection at CA-TEH-1556) (cf. CA-TEH-1488, Nilsson et al.: 1991; CA-GLE-105, Bayham and Johnson: 1990). It is not known whether the lack of diversity and variety of artifact forms may be attributed to different residence modes or a discrepancy in sampling strategies.

This unifacial scraper is discoidal in shape with high-vaulted and steeply retouched areas. Varying edge angles of 60-79 degrees have been developed through percussion and pressure flaking around the perimeter of the artifact. The uniface, recovered from 10-20 cm in Unit B, weighs 26.5gm and is 45mm in grid size.

Retouched Tool Discussion

Although microscopic use-wear studies were not conducted on these artifacts, it may be implied that these retouched tool types were used for cutting (large edge-modified piece) and scraping (uniface). It should be noted that edge modification, especially on flakes of basaltic materials, may not always be evident. Bayham concedes that a 30x magnification with a binocular microscope "failed to reveal distinctive step fractures or striations" (1976:236) on basalt flakes after performing controlled experiments for scraping and cutting specified types of bone and wood. Identification of these modified edges was only achieved by the use of microphotography. Potentially then, with the high incidence of basalt retrieved from CA-TEH-1556, flakes that have been examined macroscopically may, with future studies, be considered edge-modified pieces as well.

PROJECTILE POINT

One point of obsidian (#473-10) (length ca. 17.0 mm; width ca. 9.0 mm; thickness 2.0 mm; weight < 1.0 gm) was recovered from the 0-10 cm level of Unit A (Figure 18). Light gray/black and transparent in color, this small, side-notched specimen has been visually sourced as Tuscan obsidian. Projectile point typologies from central and northern California suggest this specimen relates to other points referred to as Desert Side-Notched (Baumhoff and Byrne 1959; Ritter 1968; Greenway 1982:146). Greenway (1982:79) places this type in this region within an A.D. 1500-1850 time frame.

Site Lithic Summary

The lithic assemblage from CA-TEH-1556 encompasses the largest class of cultural materials retrieved from the site. These artifacts, which include identifiable and unidentifiable debitage, eleven cores, one edge-modified piece, one unifacial scraper, and a projectile point were fashioned predominantly of local basalt and, secondarily, of imported obsidian. The local materials have been generously and opportunistically reduced.

Reduction strategies favor early to intermediate stage percussion techniques with evidence of early bifacial reduction. Obsidian debitage (early pressure flakes, edge preparation, and bipolar flakes) is suggestive of some formal tool formation and/or edge rejuvenation processes occurring at the site.

Reduction technologies remain fairly constant throughout the deposit, with little indication of change or fluctuation. With regard to length of occupation, it is acknowledged that this entire lithic assemblage (n=274), complete with cores, retouched tools, and a projectile point, may be replicated by an experienced, contemporary flintknapper in less than a few hours (John Fagan, Archaeological Investigations Northwest, personal communication: 1987).

SITE COMPARISONS FOR FLAKED STONE

With the exception of site CA-TEH-1554, the lithic assemblages dominate the total cultural collections retrieved from CA-TEH-1555 and -1556 and include debitage, cores, retouched tools and a projectile point. Technological analysis of all lithic artifacts suggest percussive reduction techniques were utilized on initial, early and intermediate stage materials. Intersite strategies vary little although bipolar reduction is only present at CA-TEH-1554 and -1556.

An exploration into specific reduction technologies seen diachronically at CA-TEH-1556 demonstrates minimal variation in material type. Indeed, basalt materials at all sites are overwhelmingly found. This preference may be indicative of an extended residency in the area (cf. Kelly:1985; Shackley:1985), yet the limited depth of site deposition suggests the residency was not necessarily extensive or long term.

Additionally, the mean grid size of all identifiable debitage has remained relatively constant through time, with basalt materials maintaining a generally larger overall flake size than that of obsidian and the two pieces of ccs material. Sullivan and Rozen (1989:170) believe this larger flake size nearly exclusively indicates core reduction strategies, and Kelly likens the abundant use of local materials as a "...residential aspect (which) may make use of an expedient technology" (1985:12).

Contrary to the assemblages recovered from the three rockshelter sites, often the increasing relative frequency of specialized and curated tools (particularly bifaces and projectile points) diachronically within an assemblage, has been shown to be indicative of a change in the specific logistical mobility of the prehistoric people. Indeed, Kelly demonstrates through numerous illustrations that "...as logistical mobility increases in duration and importance, more curated gear manufacture should occur in both residential and logistical sites" (1983:19). Sites CA-TEH-1554,-1555, and -1556 offer little evidence of similar mobility strategies from their lithic assemblages. As mentioned earlier, the relative frequencies of core to debitage ratios strongly suggest an opportunistic residency strategy. The assemblages demonstrate a general lack of biface trajectory types, although minimal early biface reduction techniques are evident. With the exception of the one side-notched projectile point from CA-TEH-1556, curated/specialized tools are absent.

The overall paucity of flaked stone artifacts in relation to the depth of deposition at sites CA-TEH-1554 and -1555 appears to indicate few or a single, low-density, short-seasoned occupation episode. The largest of the rockshelters, CA-TEH-1556, although retaining more depth of the midden (to 40 cm) than the other two sites, appears to have also sheltered a limited group of prehistoric peoples for limited periods of time. Notably, while debitage types are similar, subtle differences in Unit A (projectile point) and Unit B (single platform core and uniface) are thought to reflect a more specialized, yet contemporaneous, locus within the site.

Finally, noting the limited number of retouched tools (particularly the "edge-modified" flakes that are most often considered ubiquitous and expeditiously fashioned at most northern California sites) at all three rockshelter sites, and acknowledging that retouched tools regularly occur at sites with a high incidence of primary and initial core reduction, it is suggested that high-ranked resource procurement (large game, i.e. deer, bear, etc.) was, in some way, either naturally or culturally restricted for the prehistoric peoples living in these shelters.

Obsidian Studies

Within appendices 7 and 8 there can be found the detailed results of obsidian XRF and hydration studies. The XRF study was conducted in 1992 and represents knowledge on Tuscan obsidian up to that point in time and just prior to Hamusek's 1993 Master's thesis on the Tuscan source. In the 1992 report by Hamusek eight of ten samples were sourced to Tuscan and the remaining two samples were suspected as originating from the local Paynes/Inks Creek Tuscan source. This appears now to be the case with these unknowns.

The ten hydration rims on flakes and one projectile point fall within a very tight range of 1.7 to 1.9 microns. This might imply a very short occupation sequence for the two sites (CA-TEH-1555 and CA-TEH-1556) as well as contemporaneous service. However, this is a small sample and the length of use was probably somewhat longer, perhaps at times generally contemporaneous.

In examining the obsidian age-equivalent results of Bevill et al. (1996:116) for sites at a slightly higher elevation, the hydration readings at the Hogback sites would place them in the period of roughly 1100 to 1300 years ago, within the Dye Creek Complex. The one projectile point form and its reading and the C-14 date are not in congruence nor does the deposit seem to fit multi-period use unless at very infrequent, short duration intervals. At best the dating of these shelters is equivocal in terms of a fine resolution. Use was certainly late prehistoric, Mill Creek Complex in age with possible earlier use in Dye Creek Complex times. Stratigraphic differences of readings, however, is not apparent in the small sample. Obsidian was all from Tuscan sources probably not beyond the northeastern Sacramento Valley foothills.

Blood Residue Analysis

The results of blood residue analysis are presented in Appendix 9. Five specimens were shipped to Archaeological Investigations Northwest for analysis (five others discussed in the text are from other regional sites). Only one, an edge-modified multiple platform core (473-53), tested positive. The artifact tested positive for avian blood, perhaps a large game bird such as a grouse.

CONCLUSIONS

The three rockshelter test excavations overall reveal a similarity in expression and use and a general absence of complexity and substantive information potential. These sites do not appear eligible for listing on the National Register of Historic Places under criterion "D" due to their overall lack of information potential. These shelters were all apparently utilized sparingly in late prehistoric Mill Creek Complex times and perhaps for a while in Dye Creek Complex times. Use almost certainly was by small families or family groups, perhaps at times by several individuals such as economically productive women of child-bearing age. With the above being said, it is worthwhile remembering Nicholson and Cane's (1991:314) note regarding Australian aborigine rockshelter use. They found that the spatial variation of artifacts in their study suggests that space within rockshelters was not uniformly used with most artifacts located outside the shelters. "This may be due to both the artificial clearance of deposits and the fact that most stone related activities took place outside the shelters." Sampling and interpretation biases must be weighed in terms of sample representation. Furthermore, Nicholson and Cane (1991:339) found that the number of artifacts present at the habitation camps does not reflect the intensity of site use as measured by the number of camp occupants. Relevant to these general observations is a more detailed discussion offered below more or less following the research design outline as appropriate to the data recovered.

Chronology

The radiocarbon date and projectile point suggest a relatively late prehistoric occupation/use of the site. Obsidian hydration readings, on the other hand, imply Dye Creek Complex occupation/use if the conversion to age-equivalency is correct. There are no artifact or geoarchaeological indicators, such as bead or point forms, stratigraphic variation, midden depth, midden leaching, or other indicators to unequivocally indicate earlier use than

Mill Creek Complex. The obsidian hydration readings are on flakes and the point--a late type--suggesting single period use. Still, the point could have been re-used after Dye Creek Complex times. Overall our feeling is that the site is mainly Mill Creek Complex with the possibility of Dye Creek Complex use based solely on obsidian hydration readings. There is no evidence of long-term use or of activities into the historic period. A discussion of factors that may have influenced initial and terminal use is offered below.

Settlement-Subsistence

The use of these shelters appears to have been primarily residential based on the subsistence-oriented tool kits and ecofactual remains. Consider, however, that among some groups form Papua New Guinea, Gorecki (1991:256) found that "so many sites both open and caves are visited and occupied during each foraging expedition that from an ethnographic perspective it could be argued that each camp is a residential base camp. Instead it is quite clear that the 'base camps' are only camps or field stations."

The flora and fauna data imply at least fall use (acorns, deer, rabbits, hard seeds) (see Wiant 1981) with possible site visitation in late spring-early summer (clover, grass seeds, geophytes). Geophyte utilization can be only indirectly hypothesized based on flaked stone tools that could have been used in producing and sharpening digging sticks as well as employment in the more traditional inferred uses such as butchering and processing game. There is no indication of salmonid usage nor any suggestion of an extremely diversified food base. The absence of gray pine nuts and manzanita seeds are examples in terms of plant foods. This may be a sampling product as much as an indication of overall subsistence orientation. One is left with the impression that the archaeological expressions reflect a seasonally dispersed small group or family-oriented foraging/hunting system from late prehistoric times, an inference further discussed below.

As noted by Ellen (1988:133), "all modes of subsistence are necessarily encapsulated in a particular web of social and ecological relations." The domestic level of production so evident in these sites must be viewed as part of a larger system or systems. It is probable that during use of these rockshelters there was a certain economic level of independence with a number of major, nutritious food sources easily reachable (within a few kilometers) including acorns, geophytes, seeds, and small to large animals. Stream-related resources, at least in terms of easily acquired mussels and turtle, were within permissive walking distance. Sharing of resources can only be inferred.

At times of the year when these shelters were not utilized, probably in mid-winter and mid-summer at least, aggregations of individuals at higher elevations (summer) and at major stream-side sites (winter) for social solidification, exchange, discourse, and consolidation would have been at least temporarily beneficial in terms of information exchange, partner selection, ritual reinforcement of social order, and the like.

More than likely these shelter sites represent foragers/collectors moving out to food resources on a seasonal basis, first to a small base camp--or foraging camp--and then with short forays to specific resource patches or specific locations such as along deer migratory routes. The shelters happened to be conveniently located for use lessening energy costs necessary in building houses and setting up an open camp. A widespread survey of adjoining locations has not been conducted. However, it is expected that most rockshelters--canyon bottom to canyon rim--will show some indication of occupation; that small residential locations will be located at select flats or terraces along Salt and Antelope creeks, near the Valley-foothill interface along streams (see Nilsson et al. 1991), and possibly in upland zones near springs; that scattered flaked stone tools and debitage will represent food gathering areas, game processing locations, as well as cobble testing areas; and that hunting blinds will occur in select locations. This is obviously a simplified view of site distribution and type without chronological leverage leaving out some specialized situations (rock art, rock structure, milling station, etc.), but one that can be projected based on the numerous surveys (see Wiant 1981, Hamusek and Kowta 1991, Hamusek 1996, Bevill et al. 1996, and the unpublished work undertaken by Dr. Jerald Johnson of California State University along Dye, Mill, Deer and other creeks--site records on file at California State University, Chico). Such a projection helps focus the settlement-subsistence scenario involving these sister shelters. The use of the three shelters discussed here does not appear to vary much from that reported from similar shelters by Ritter (1987) and by Sundahl (1993) except in terms of perceived intensity, group size, and possibly longevity of use.

Technological Considerations

The artifact assemblages are most distinguished by their relative simplicity and lack of diversification. Stone tools and stone tool making refuse are the only categories represented. With shelters one might expect perishables but such was not the case. Unexpectedly, there were no artifacts of bone or shell, no ornaments, no carbonized basketry or cordage, no mortars or pestles; no netweights, hammerstones, bifaces or drills; a fairly rudimentary tool kit for milling foods and undertaking cutting, scraping, chopping activities and hunting/protection. A larger sample, of course, may have led to the discovery of a few more artifact categories, but the general behavior-related inferences would likely change little.

The observed technology is basically expedient with an absence of curated/specialized tools. However, some of these tool types could have been carried with them and/or the people were not at the sites long enough to discard worn or broken items nor were they wealthy enough to place any specialized non-perishable items with the infant burials (other cultural factors aside). Raw materials are all available in the immediate vicinity with the exception of some of the obsidian which can be found throughout the general southern Cascades foothills.

The technology does not suggest extended residency, as one might infer with evidence of re-use. The dominance and make-up of the lithic assemblage (non-shaped milling tools, cores, core tools and flakes, and ratio of cores to flakes; initial, early and intermediate stages of percussion and rare bipolar flaking; absence of many tool categories, and presence of a single projectile point) suggest an opportunistic residential strategy at the three shelters. In fact, the various tool categories, with the exception of the projectile point, could be accounted for primarily by women's activities. Certainly the infant burials, perhaps from stillborns, attest to women's presence and temporary residency.

Trade-Exchange

None of the archaeological remains conclusively represents an example of trade/exchange. Obsidian could have been procured relatively locally or could have been imported by contacts with the same ethnic group a little more distant, but probably less than about 50 km away. Similarly, there is no suggestion of local manufacture of material goods for export, although certain items such as baskets have not preserved. In this case and similar cases, though, one would expect to find manufacturing tools and debris such as bone or stone awls.

Site Formation/Transformation Processes

The three shelters exhibit cultural materials both within and outside in their aprons. There is some archaeological differentiation between interior and exterior areas, as with the infant burial outside within the apron, milling or milling tool placement within the shelter; and discard outside, especially fire-affected rock. A larger sample would probably reveal more spatial distinctions.

All of the rockshelters exhibit bioturbation and relatively shallow deposits. Cultural contributions to the soil/sediments of the shelters are relatively slight based on soil chemistry and midden development criteria. Sediment/soils do not indicate multiple periods of use or activities, perhaps due to bioturbation factors. As noted by Gorecki (1991:255) regarding Papua New Guinean shelter use, "each living floor in a confined space such as a rock shelter reflects many accumulated occupational events."

General Discussion

Information and interpretation from this small testing program finds its most hardy ground in the realm of mode of subsistence, mobility, and group structure. Without a broader, more comprehensive study it is difficult to offer more than a few comments regarding the causes of initial site occupation/use. Yesner (1994:166-167) has pointed out that nearly all hunter-gatherers living in seasonal environments are affected by the seasonality of resources through some degree of episodic stress. If this is so, some of these stresses exerted on the Yana ancestors of these sites could be population increase, shrinking land base and population concentrations due to Penutian intrusions, climatic perturbations as outlined by Jones et al. (1999), resource over-exploitation, technological change

influences (bow and arrow and greater hunting and defensive prowess), or some combination of factors. A likely reaction to these stresses would have been a change in mobility/subsistence practices as well as ritual-ideological responses beyond the scope of this report.

Bernbeck (1991) has demonstrated that mobility is a primary mechanism for alleviating crises due to resource availability problems. The model offered here is that as a reaction to societal crises, especially in the realm of food and nutrition during Dye Creek or initial Mill Creek Complex time, foraging/collecting groups became smaller and more broadly dispersed. This would result in a more dependable harvest of both fixed and non-fixed plant and animal resources enacted from scattered base camps within canyons and on divides of the foothills, at least on a seasonal or multiple seasonal basis (but see Kelly [1995:147-148] for reasons behind non-subsistence related movements). Furthermore, as pointed out by Barnard and Woodburn (1988:22), a certain level of food and other resource sharing between camps or groups/sub-groups both influences the size and structure of camp units but probably also serves to help alleviate stresses related to daily life.

In summation based on Hogback Ridge information and other comparative data, the model proposes late prehistoric changes in productivity, settlement and decision-making with a resultant non-quantified level of resource intensification, especially with regard to plant foods such as geophytes as found on the hillsides surrounding these shelters (see Price and Brown 1985:10-11). Specialized uses for these shelters at times cannot be ruled out entirely, either, as for birthing. Abandonment may have coincided with historic intrusions and population losses and retrenchment into larger camps.

We have seen that these shelters are not particularly complex archaeologically speaking and do not appear singly or as a group to meet the threshold of National Register of Historic Places eligibility due to a shortage of scientific data. Still, they have provided information that should serve to bolster regional models of past Native American Indian life.

REFERENCES CITED

Anderson, M. Kat

1997 From Tillage to Table: The Indigenous Cultivation of Geophytes for Food in California. Journal of Ethnobiology 17(2): 149-169.

Barbour, Michael G., and J. Majors (eds.)

1977 Terrestrial Vegetation of California. John Wiley and Sons, New York.

Barnard, Alan, and James Woodburn

1988 Property, Power and Ideology in Hunting and Gathering Societies: An Introduction. In Hunters and Gatherers, Property, Power and Ideology Volume 3, Tim Ingold, David Riches and James Woodburn, eds. pp.4-31. Berg Publishers Ltd., Oxford.

Baumhoff, Martin A.

1955 Excavation of Site TEH-1 (Kingsley Cave). University of California Archaeological Survey Report No. 30, Berkeley.

1957 An Introduction to Yana Archaeology. University of California Archaeological Survey Report No. 40, Berkeley.

Baumhoff, M.A., and J.S. Byrne

1959 Desert Side-Notched Points as a Time Marker in California. University of California Archaeological Survey Report No. 48:32-65, Berkeley.

Bayham, Frank E.

1976 Desert Resources and Hohokam Subsistence: The Conoco Florence Project, edited by William H. Doelle, pp. 195-217. Archeological Series 103, Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

Bayham, Frank E., and Jack M. Broughton

1990 Animal Utilization in the North Sacramento Valley. In Archeological Investigations at CA-GLE-105: A Multicomponent Site Along the Sacramento River, Glenn County, California, by Frank E. Bayham and Keith L. Johnson, pp. 129-158. Archaeological Research Program Report No. 90-109 prepared for the U.S. Department of the Army Corps of Engineers, Sacramento District. California State University, Chico.

Bayham, Frank E., and K.L. Johnson

1990 Archeological Investigations at CA-Gle-105: A Multicomponent Site Along the Sacramento River, Glenn County, California. Archaeological Research Program Report No. 90-109, prepared for the U.S. Department of the Army Corps of Engineers, Sacramento District. California State University, Chico.

Bayham, Frank E., D.H. Morris, and M. S. Shackley

1986 Prehistoric Hunter-Gatherers of South Central Arizona: The Picacho Reservoir Archaic Project. Office of Cultural Resource Management, Department of Anthropology, Arizona State University, Tempe.

Bennett, John W.

1976 The Ecological Transition: Cultural Anthropology and Human Adaptations. Pergamon Press, Inc. New York.

Bennyhoff, James A., and Richard E. Hughes
1987 Shell Bead and Ornament Exchange Networks Between California and the Western Great Basin. Anthropological Papers of the American Museum of Natural History, Vol. 64, Part 2, pp. 79-175. New York.

Bernbeck, Reinhard
1991 Crisis in the Foraging Mode of Production: Long-Term Cyclical Processes in Hunter-Gatherer Studies. In Foragers in Context, Long-Term, Regional, and Historical Perspectives in Hunter-Gatherer Studies, Preston T. Miracle, Lynn E. Fisher and Jody Brown, eds., pp.47-62. Michigan Discussions in Anthropology, Vol. 10. Ann Arbor.

Bettinger, Robert L.
1991 Hunters-Gatherers, Archaeological and Evolutionary Theory. Plenum Press, New York.

Bevill, Russell, Kathleen Hull, and Elena Nilsson
1996 Archaeological Investigations at CA-TEH-563 and FS 05-06-51-40, Located within the Ishi Wilderness, Lassen National Forest, Tehama County, California. Submitted to Lassen National Forest, Susanville, CA.

Binford, Lewis R., and G.I. Quimby
1972 Indian Sites and Chipped Stone Materials in the Northern Lake Michigan Area. In An Archaeological Perspective, edited by L.R. Binford, pp. 346-372. Seminar Press, New York.

Butzer, Karl W.
1982 Archaeology as Human Ecology. Cambridge University Press, Cambridge.

Cornwall, I.W.
1958 Soils for the Archaeologist. Phoenix House, London.

Crabtree, Don E.
1982 An Introduction to Flintworking (Second Edition). Idaho State University Museum, Occasional Paper 28, Pocatello.

Dreyer, William R.
1984 Prehistoric Settlement Strategies in a Portion of the Northern Sacramento Valley, California. Master's Thesis, Department of Anthropology, California State University, Chico.

Earle, T., and R. Preucel
1987 Processual Archaeology and the Radical Critique. Current Anthropology 28:501-538.

Ellen, Roy
1988 Foraging Starch Extraction and the Sedentary Lifestyle in the Lowland Rainforest of Central Seram. In Hunters and Gatherers 1, History, Evolution and Social Change , Tim Ingold, David Riches and James Woodburn, eds. pp.117-139. Berg Publishers Ltd., Oxford.

Flenniken, J. Jeffrey
1987 The Lithic Technology of the East Lake Site, Newberry Crater, Oregon. Submitted to U.S. Forest Service, Deschutes National Forest, Bend.

Frison, George C., and B.A. Bradley
1980 Folsom Tools and Technology of the Hanson Site, Wyoming. University of New Mexico Press, Albuquerque.

Gifford, E.W., and S. Klimek
1939 Culture Element Distributions: II Yana. University of California Publications in American Archaeology and Ethnology 37:71-100. Berkeley.

Gorecki, Paul P.
1991 Horticulturalists as Hunter-Gatherers: Rockshelter Usage in Papua New Guinea. In Ethnoarchaeological Approaches to Mobile Campsites, C.S. Gamble and W.A. Boismier, eds., pp. 237-262. International Monographs in Prehistory, Ethnoarchaeological Series 1. Ann Arbor.

Gowans, K.D.
1967 Soil Survey of Tehama County California. U.S. Department of Agriculture Soil Conservation Service, Washington, D.C.

Greenway, Greg
1982 Projectile Point Variability at Dead Man's Cave (CA-TEH-290) in the Southern Cascade Mountains of Northeastern California. Master's Thesis, Department of Anthropology, California State University, Sacramento.

Greenway, Greg, and E. Nilsson
1986 The Technological and Distributional Aspects of Kelly Mountain Obsidian, Plumas County, California. Paper presented at the Society for California Archaeology Meeting, Santa Rosa.

Hayden, B.
1979 Snap, Shatter, and Super-Fractures: Use-Wear of Stone Skin Scrapers. In Lithic Use-Wear Analysis, edited by B. Hayden, pp. 207-229. Academic Press, New York.

Hamusek (McGann), Blossom
1988 The Stratigraphy and Archaeology at CA-TEH-1490: A Hunting Camp in Yana Territory, Northern California. California Department of Forestry and Fire Protection, Sacramento.

1993 What "X" Equals: The Archaeological and Geological Distribution of "Source X" Tuscan Obsidian in Northern California. Master's Thesis, Department of Anthropology, California State University, Chico.

1996 A Cultural Resource Survey of the Bend Area, Tehama County, California. Bureau of Land Management Cultural Resources Publications: Archaeology. Redding.

Hamusek, B.J., and M. Kowta
1991 The Inks Creek Survey Project in the Upper Sacramento Valley, Tehama County, California. Submitted to the Bureau of Land Management, Redding.

Henry, Don O., C. V. Haynes, and B. Bradley
1976 Quantitative Variation in Flaked Stone Debitage. Plains Anthropologist 21:57-61.

Jensen, Peter M., and Paul R. Reed
1979 An Anthropological Overview and Cultural Resources Inventory of the Northern Sacramento Valley and Southern Cascade Range. Bureau of Land Management, Redding.

Johnson, Jerald J.
1976 Southern Cascade Mountain Research Project (1960-1975). Paper presented at the Society for American Archaeology Meeting, St. Louis.

1978 Yana. In California, Handbook of North American Indians, Volume 8, Robert F. Heizer, ed., pp. 361-369. Smithsonian Institution, Washington.

1983 Possible Criteria for Distinguishing Archaeological Cultural Boundaries Between Two Closely Related Ethnographic Wintun Populations and an Adjacent Yana Population. Paper presented at the Society for American Archaeology meeting, Pittsburgh.

1984 Groundstone Assemblages in Northeastern California. Ph.D. Dissertation, Department of Anthropology, University of California, Davis.

n.d. Archaeological Investigations in Northeastern California (1939-1979). Ms. on file, Department of Anthropology, California State University, Sacramento.

Johnson, Jerald J., and D.J. Theodoratus

1984 Dutch Gulch Lake Intensive Cultural Resources Survey. U.S. Army Corps of Engineers, Sacramento.

Johnston, J.D.

1975 Carbonates: A Chronological Indicator. Master's Thesis, Department of Anthropology, California State University, Sacramento.

Jones, Terry L., Gary M. Brown, L. Mark Raab, Janet L. Vickar, W. Geoffrey Spaulding, Douglas J. Kennett, Andrew York, and Phillip L. Walker

1999 Environmental Imperatives Reconsidered: Demographic Crisis in Western North America During the Medieval Climatic Anomaly. Current Anthropology 40(2): 137-170.

Kelly, Robert L.

1983 Hunter-Gatherer Mobility Strategies. Journal of Anthropological Research 39:277-306.

1985 Hunter-Gatherer Mobility and Lithic Technology. Paper presented at the Society for American Archaeology meeting, Denver.

1995 The Foraging Spectrum, Diversity in Hunter-Gatherer Lifeways. Smithsonian Institution Press, Washington.

Kowta, Makoto

1975 The Regional Research Design. Ms. on the file with the Department of Anthropology, California State University, Chico.

Kroeber, Theodora

1961 Ishi in Two Worlds: A Biography of the Last Wild Indian in North America, University of California Press, Berkeley.

Munz, Phillip A. in collaboration with David D. Keck

1959 A California Flora, University of California Press, Berkeley.

Nicholson, Annie, and Scott Cane

1991 Desert Camps: Analysis of Australian Aborigine Proto-historic Campsites. In Ethnoarchaeological Approaches to Mobile Campsites, C.S. Gamble and W.A. Boismier, eds., pp. 263-354. International Monographs in Prehistory, Ethnoarchaeological Series 1, Ann Arbor.

Nilsson, Elena
1988 Flaked Stone Artifacts from CA-Men-2138. Draft submitted to PAR & Associates, Sacramento.

Nilsson, Elena, S. Flint, and G. Greenway
1991 Archaeological Test Excavations at CA-TEH-1488, the New Creek Site, Tehama County, California. Submitted to the Tehama County Road Department, Gerber.

Orlove, Benjamin S.
1977 Cultural Ecology: A Critical Essay and a Bibliography. University of California, Davis Institute of Ecology Publication No. 13, Davis.

Patterson, L.W., and J.B. Sollberger
1978 Replication and Classification of Small Size Debitage. Plains Anthropologist 23:103-112.

Powers, Stephen
1877 Tribes of California. Contributions to North American Ethnology 3. U.S. Geographical and Geological Survey of the Rocky Mountain Region, Washington, D.C.

Price, T. Douglas, and James A. Brown
1985 Aspects of Hunter-Gatherer Complexity. In Prehistoric Hunter-Gatherers, The Emergence of Cultural Complexity, T. Douglas Price and James A. Brown, eds., pp.3-20. Academic Press, San Diego.

Redman, Charles L.
1991 Distinguished Lecture in Archeology: In Defense of the Seventies- The Adolescence of New Archaeology. American Anthropologist 93(2): 295-307.

Ritter, Eric W.
1968 Culture History of *Tie Wiah* (4-BUT-84), Oroville Locality, California. Master's Thesis, Department of Anthropology, University of California, Davis.

1987 Archaeological Test Excavations at Spider Rockshelter (CA-TEH-1432), Lower Mill Creek Canyon, California. Cultural Resources Report: Archaeology. Bureau of Land Management, Redding.

Sapir, E., and L. Spier
1943 Notes on the Culture of the Yana. University of California Anthropological Records 3 (3) 239-298. Berkeley.

Shackley, M.S.
1985 Lithic Raw Material Procurement and Hunter-Gatherer Mobility Strategies in the Southwest Archaic. Paper presented at the Society for American Archaeology meeting, Denver.

Setzer, J.
1947 Chemical Analysis of Indian Mounds. Master's Thesis, Department of Anthropology, University of California, Berkeley.

Spencer, Eileen
1988 Fired Clay Technology in the Northern Sacramento Valley. Paper presented at the Society for California Archaeology meeting, Redding.

Stein, Julie K.
1985 Interpreting Sediments in Cultural Settings. In Archaeological Sediments in Context, Julie K. Stein and William R. Farrand, eds., pp. 5-21. Center for the Study of Early Man, University of Maine, Orono.

Sullivan, A.P., and K.C. Rozen
1989 Measurement, Method, and Meaning in Lithic Analysis: Problems with Amick and Maudlin's Middle Range Approach. American Antiquity 54 (1): 169-175.

Sundahl, Elaine
1993 Archaeological Excavations in the Bend Area, Tehama County, California. Shasta College Archaeology Lab Report, Redding.

1996 West Redding Archaeological Project: CA-SHA-1556 and CA-SHA-1738, The Quartz Hill Sites. Shasta College Archaeology Lab Report, Redding.

Tringham, R., G. Cooper, G. Odell, B. Voytec, and A. Whitman
1974 Experimentation in the Formation of Edge Damage: A New Approach to Lithic Analysis. Journal of Field Archaeology 1:171-196.

Vaughan, Trudy
1992 Archaeological Investigations at CA-SHA-47 and CA-SHA-236 on the Sacramento River, Redding, Shasta County, California. Coyote & Fox Enterprises. Submitted to City of Redding.

Waterman, T.T.
1918 The Yana Indians. University of California Publications in American Archaeology and Ethnology 13(2): 35-102. Berkeley.

Whistler, Kenneth W.
1977 Wintun Prehistory: An Interpretation Based on Linguistic Reconstruction of Plant and Animal Nomenclature. Paper presented at the Proceedings of the Third Annual Meeting of the Berkeley Linguistics Society. University of California, Berkeley.

Wiant, Wayne C.
1981 Southern Yana Subsistence and Settlement: An Ecological Model. Master's Thesis, Department of Anthropology, California State University, Sacramento.

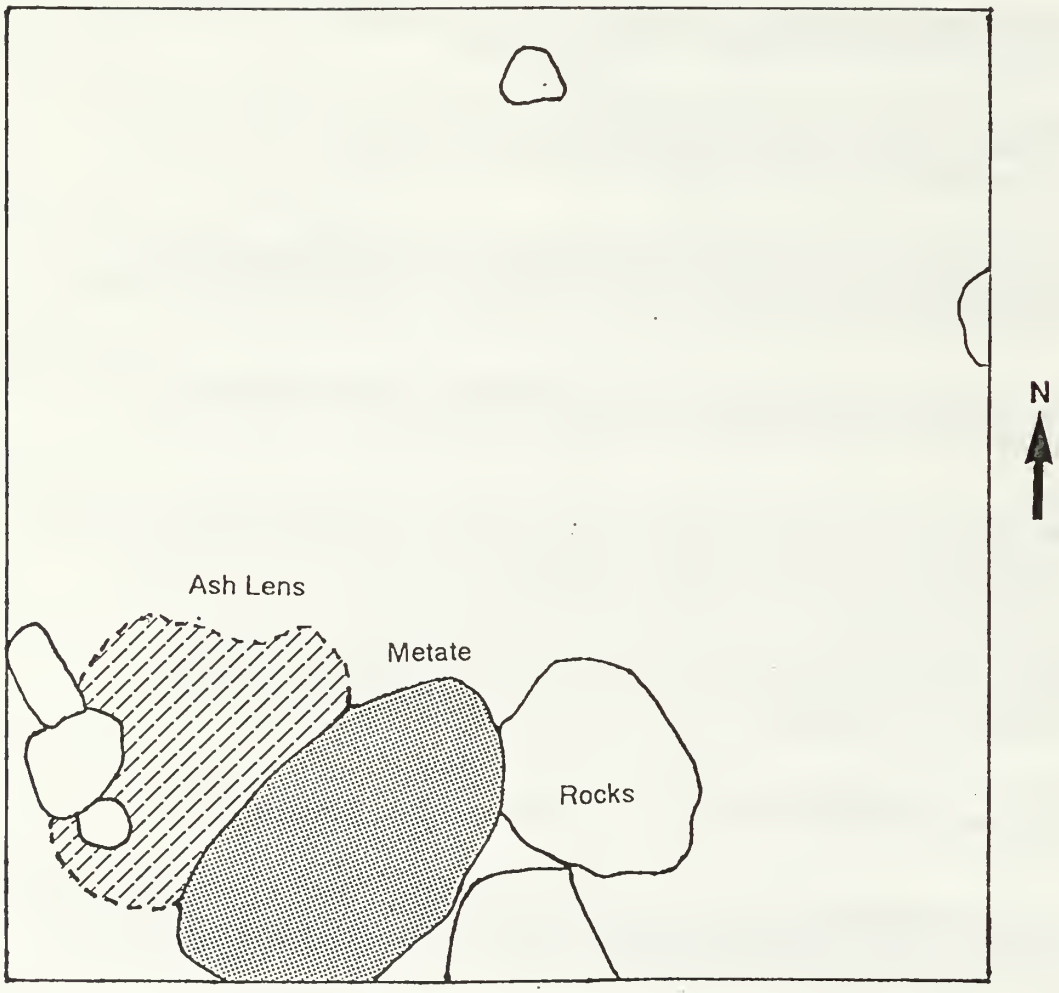
Wilmsen, Edwin N.
1974 Lindenmeier: A Pleistocene Hunting Society. Harper and Row, San Francisco.

Yesner, David R.
1994 Seasonality and Resource "Stress" Among Hunter-Gatherers: Archaeological Signatures. In Key Issues in Hunter-Gatherer Research, Ernest S. Burch, Jr. and Linda J. Ellanna, eds. pp. 151-168. Berg Publishers, Inc. Oxford.

Figure 19

CA-TEH-1556

UNIT B FEATURE 2



APPENDIX 1

RESEARCH DESIGN FOR ARCHAEOLOGICAL INVESTIGATIONS WITHIN THE FOOTHILL REGION OF THE SOUTHERN CASCADES WITH EMPHASIS ON LIMITED TESTING OF B&B ROCKSHELTER (CA-TEH-1554), BLUE DICK ROCKSHELTER (CA-TEH-1555), AND PIPEVINE ROCKSHELTER (CA-TEH-1556)

ERIC W. RITTER

The research orientation directed at the three rockshelters reflects the author's biases toward cultural and evolutionary ecology (Neo-Darwinism), cultural materialism, and cultural inheritance and transmission (e.g. Bettinger 1991, Bennett 1976, Orlove 1977, and Butzer 1982). The bottom line, however, is more rudimentary: Do these shelters have meaningful cultural materials present or not, and if they do what can be learned about past human cultures from these remains?

Orlove (1977:7) notes:

> ...processual cultural ecology examines the interaction of populations and environments, rather than treating the latter as a passive background to the former. The studies are called processual because they examine shifts and changes in individual and group activities, and because they focus on the mechanisms by which external constraints influence behavior. These points indicate the importance of the incorporation of decision-making into cultural ecology.

Butzer (1982:xi), in a similar direction, indicates that the central concept in the dynamic interactions between human groups or societies and their environment is the human ecosystem. He stresses the interdependence of cultural and environmental variables.

It seemed evident that the testing of these rockshelters could be best approached from a perspective of social and environmental dynamics and evolution. A critical aspect of such studies, at least at a stage when more comprehensive investigations occur, is a thorough assessment of the regional paleoecology. Generally this was beyond the scope of the limited testing program.

The primary aims of the limited investigations at each site will be to determine and record: (1) the extent of the deposit; (2) the content and age of the deposit and materials and site function; (3) the significance of the site in terms of its regional setting; and (4) management needs. From an anthropological perspective the primary aim of the recovery-oriented operations will be to understand to the greatest extent possible: (1) culture chronology, (2) the subsistence and settlement strategies and cultural and natural ecology from a dynamic perspective, (3) issues of technology and cultural inheritance and transmission, especially trade and exchange, and (4) deposit forming factors. Other topics such as socio-political organization, ideology, and population movement and pressures will be considered in a secondary fashion as the data permit.

The cultural dynamics of the major topics will be explored to the extent possible in terms of processual questions (changes and decision-making). Attempts at answering questions related to the above topics are predicated on sample size or the nature of the data available, the amount of data recovered, and the treatment of the recovered data. One cannot be presumptuous in assuming that all questions can be answered with a sample or, for that matter, all of the sites' contents while bringing in information from other regional studies.

It is difficult to judge the outcome of the small sample test excavations because of the inherent dangers of deriving conclusions from what cannot be anything but a biased sample. Nevertheless, testing within the constraints permitted by funding and labor can allow BLM or another agency or individual to be reasonably responsive to both management needs and scientific concerns.

Jensen and Reed (1979:138-139) have noted that the scientific or research potential of archaeological resources in north-central California derive from three basic considerations: culture history and population movement; understanding socio-economic and socio-political responses to changing modes of subsistence and increasing population densities; and use of the ethnographic baseline. Kowta (1975:11-12) has proposed a series of general working hypotheses related to these topics, some of which have been rethought and augmented.

In summary fashion, these hypotheses are as follows:

1. Prior to 3000 B.C. northern California foothill areas were occupied primarily by very mobile hunting and gathering Hokan speakers who relied on the exploitation of game and hard seeds with mano and metate processors for the seeds.

2. About 3000 B.C. Penutian speakers penetrated the lightly occupied Central Valley bringing with them a lifeway and subsistence mode oriented toward riverine and marshland resources.

3. In time, Valley Penutians utilized their pre-existing subsistence mode to exploit the rich acorn crops which, when combined with salmon fisheries and other food gathering practices, resulted in population expansion into some foothill areas (and mountain meadows) where salmon/acorn exploitation could continue.

4. Hokan speakers relinquished traditional territories, perished, or were left in marginal areas, such as the study locality where they were located in historic times (Kowta 1975:11-12).

Jensen and Reed (1979:140-152) provide further discussion on Kowta's model, based on Whistler's (1977) more recent analysis of Wintun prehistory. Whistler has postulated that four Penutian groups, each of which originated outside of California within Oregon or the Great Basin, entered and occupied much of California.

Johnson (1983), with an update by Johnson and Theodoratus (1984:42), has presented a general model following on the heels of Kowta and Whistler but with considerable efforts on his own behalf.

This model would have (proto) Hokan speakers experimenting with acorn use before the (proto) Penutian intrusion. The initial Penutian intrusion may have occurred as an aftermath of the eruption of Mount Mazama in their homeland about 6900 B.P. Through intermarriage between Penutian and Hokan speakers refined acorn processing was productive among both groups; and manos and metates continued to be used for a time by Penutian groups.

With plentiful fish, clams, bulbs, tubers and acorn use in the Sacramento Valley, the Penutian peoples experienced a population growth far greater than the neighboring Hokan speakers. This led to an expansion of Penutian speakers into all parts of the Sacramento Valley and some adjacent mountain ranges sometime after A.D. 200. The Wintun ancestors occupied much of their territory by A.D. 600-700 and, as demonstrated by Johnston (1975), were pressuring the Yana into relinquishing Valley territory and withdrawing into foothill zones by A.D. 1500.

With the above discussion as a background and considering the introductory sections on the local archaeology and ethnography, the specifics of this research design can be presented. This design is set up by major topics of investigation, each with a series of research questions, hypotheses, and testing mechanisms. Through this method of presentation, the conclusions can be similarly approached exploring each portion as the data.

UNITS OF ANALYSIS

I. Culture Chronology

Establishing an accurate chronology or culture history of human occupation and use remains one of the keys to meaningful behavioral research. Time sensitive or diagnostic artifacts and technologies (e.g., lithic reduction systems) can be useful in dating but must be supplemented to the extent possible by obsidian

hydration, radiocarbon dating, and geoarchaeological means.

A. Research Questions

Those research questions relevant to the investigated sites include the following:

1. When were the sites occupied and abandoned, and what are the causes for initial and terminal use? How do their occupational histories compare to other regional sites?

2. How do site contents relate to what is presently known about the "Mill Creek Complex" or earlier complexes?

3. Are there local variations present in each site's assemblage and between sites?

4. Is there a cultural developmental sequence evident at any of the sites?

5. Are the site contents conducive to understanding regional culture change and dynamics?

6. What time markers or time-sensitive technologies are present? What is the range of their variability? Can these time markers or technologies be refined or augmented? Can new ones be established?

7. How do the rockshelter deposits' depth (accumulation) relate to cultural/natural(age) processes?

8. Does site content indicate historic contact and, if so, what is the nature and extent of this contact?

B. Hypotheses

1. The sites will primarily relate to Mill Creek Complex activities/occupation, but may have indications of earlier more limited use and site content will reflect defined assemblages.

2. Midden accumulation will primarily represent limited use of the shelter by individuals or single families for less than 500 years (post circa A.D. 1500).

3. Initial site use will be the result of a contracting use area and stable or expanding population.

4. Historic artifacts, if present, will relate to re-use of lost or discarded European artifacts associated with passage along historic trails, or nearby homesteading.

5. Site abandonment will be related to the introduction of European culture and diseases, depredation of the aboriginal populations by Europeans, and subsequent further shrinkage of utilized areas to refuge site locations, followed by group extinction.

6. Site assemblages reflect dispersed patterns of small residential sites used seasonally by relatively mobile hunters and foragers to more efficiently utilize dispersed fixed (e.g. acorns, seeds, roots) and transitory (e.g. deer, salmon) resources.

C. Testing Mechanisms

1. Controlled excavation with a dispersed sample of two to three 1 m x 1 m units representing more than 5%

of the deposit. Excavation by arbitrary 10 cm levels unless stratigraphy dictates otherwise.

2. Ethnohistoric documentation.

3. Obtain an adequate sample of obsidian, if available, to perform hydration/sourcing by stratigraphic position.

4. Adequately assess technological items and processes using comparative literature for time placement; assess materials for relative stratigraphic position - tie in with soil/sediment analysis, C-14 dating, and obsidian studies.

5. C-14 date at least one sample from a location pertinent to the occupation sequence (e.g. base of midden) at one or more shelters.

6. Perform adequate soil/sediment profile/recordings and analysis to understand site formation processes and to elucidate stratigraphic events (profile each unit; secure soil samples on and off-site for comparison).

7. Obtain a sufficient sample of known and potential time markers--if possible under logistical constraints--to date site occupation and clarify time marker placement, if necessary.

II. Settlement/Subsistence

Wiant (1981) and more recently Nilsson, Flint and Greenway (1991) have presented a series of settlement/subsistence models and research designs for the general study locality that can be partially applied to the study sites.

A. Research Questions

1. Do the data (i.e., material culture elaborations) support Wiant's (1981:105) rejected model which views the Southern Yana and their near-ancestors as culturally poor who expended substantial time and energy in the quest for food?

2. Do the data support Wiant's (1981:124) preferred model? The model takes an opposite view of that stated above, where food surpluses, such as salmon, were common; there was resulting free time and flexibility in scheduling activities, and a mixed strategy of resource exploitation, with summer movement to higher elevations and material cultural elaborations.

3. Based on food remains and other resources, were the rockshelters utilized in the fall, as Wiant suggests was the regional occupation pattern?

4. What resource (food product) use is evident, as can be inferred from the plant, animal, artifact and feature remains present in the rockshelter? How were these plants and animals procured, processed, and consumed?

5. What butchering practices are evident on faunal remains and what was the disposal pattern for food remains?

6. Do the rockshelter remains reflect any changes in subsistence over time? If changes are present, what brought them about?

7. How do the rockshelters relate spatially and temporally with the known site distribution in the region

(e.g. 15 km radius) and variability in site configuration? How does this pattern compare with a recent study of similar nearby rockshelters in the Bend Area (Sundahl 1993) and Mill Creek Canyon (Ritter 1987)?

8. How do the rockshelter sites fit with local micro- and macro-environments (optimal habitation use areas as opposed to moderate and peripheral areas), and what attributes led to the selection of these sites (natural and locational features)?

9. Were the sites utilized sporadically over time or for one brief period and was this use contemporaneous?

10. What plant and animal remains were used for non-subsistence purposes, e.g. utilitarian, decorative?

11. Are special food processing stations evident at any of the sites?

12. Are special food consumption areas present at any of the sites?

13. How do food resource remains relate to distance to present or past source areas?

14. What potential food resources in the sites' vicinity were not exploited based on recovered remains?

15. How did procurement practices relate to cost-benefit ratios on a subjective basis?

16. What is the correspondence between recovered food remains and technological items, and what significance, if any, does the correspondence hold?

17. Are there dietary changes observable in the food/tool and feature remains? What influences precipitated the changes?

18. What are the implications of the sites' food remains with respect to population social structure?

B. Hypotheses

1. The greatest concentration of sites will be focused along the principal drainages and local zones with the greatest potential diversity/productivity of highly ranked food products within Valley-edge and foothill zones.

2. Inhabitants will make use of the inhabitable rockshelters within the local canyons, but at varying levels and times depending on size and proximity to high ranked food sources.

3. The study rockshelters represent an intermediate zone of long-term food diversity/productivity, but with easy proximity to long-term rich zones or pathways.

4. The study rockshelters represent secondary activity locations to primary sites such as large rockshelters and open villages within major canyons.

5. The study rockshelters represent task-specific subsistence oriented bases for fall hunting and gathering activities.

6. Each rockshelter was utilized by no more than approximately one family at any one time.

7. The flaked and ground stone assemblage will reflect a diverse procurement pattern, both hunting and

gathering/foraging.

8. The flaked stone assemblage will reflect hunting-butchering-animal processing activities of both large game (e.g. deer) and small game (e.g. rabbits).

9. The ground stone assemblage and micro- and macro-floral remains will reflect both soft vegetal (e.g. acorn) and hard vegetal (e.g. grass seed) processing, with emphasis on the latter through time.

C. Testing Mechanisms

1. Examine regional site records and excavation reports as a comparative base.

2. Map or evaluate local micro-and macro-environmental factors deemed relevant (catchment analysis).

3. Excavation of a representative sample to obtain food remains, technological items and features, and related associations suitable for meaningful analysis.

4. Hearth flotation/recovery. Midden flora and faunal remains supplemented by screening with 1/8".

5. Blood residue analysis on a select number of flaked and ground stone artifacts.

III. Technology

It is assumed that late prehistoric/protohistoric inhabitants of the region utilized tool kits oriented toward hunting, gathering/collecting, processing, and consuming a wide range of wild plants and animals. Families generally manufactured most items needed for their day-to-day life with some craft specialization and acquisition by trade or exchange. Flaked and ground stone and bone tools and ornaments predominated in the assemblages. Basketry, feather work, etc. were important cultural items and could be recovered if dry deposits occur.

It is known that the bow and arrow replaced the atlatl-dart. It would also appear that hopper mortars and flat-ended pestles were later than milling slabs and manos. Ceremonial/ritual objects were relatively few, assuming the society was largely egalitarian.

Details of the early historic Southern Yana technology can be found in Waterman (1918) and Sapir and Spier (1943), among others.

A. Research Questions

1. What technologies are expressed at the site?

2. How do these technologies compare with previously identified regional technologies?

3. Are any innovative means of artifact production evident?

4. Are there changes in technology evident over time (stratigraphically) or are they consistent over time?

5. What items are being produced or furnished locally, and which are imports?

6. What are the trajectories of stages of manufacture of flake-stone implements employed at the

various sites, and what are the behavioral implications spatially and chronologically for site function, exchange and trade, and stone tool technology?

7. What technological items are missing (perishables) which might be inferred from other items (e.g. hopper mortars, bone awls - baskets; fish weirs, nets; arrow points - arrows, etc.)?

8. Are any perishables evident through dry-deposit preservation, carbonization, etc.?

9. What energy levels (length and intensity of manufacture) are expressed in technological items?

10. How does this energy expenditure factor relate to adaptation efficiency and mobility?

11. Does the lithic technology practiced by shelter occupants reflect differential treatment for obsidian and non-obsidian specimens?

B. Hypotheses

1. The site assemblages will be dominated by tools and implements (and their byproducts) related to day-to-day activities with few or no items of ornamental or ceremonial/ritual use.

2. No evidence of change in manufacturing techniques will be evident at the site.

3. The availability and quality of some stone materials influenced the technological processes evident in the site.

4. Utilitarian items requiring little labor in manufacture will exhibit evidence of short-term use.

5. Utilitarian items requiring considerable manufacture time will exhibit long-term (heavy) use.

6. Flaked stone tools are brought to the site in finished form with incidental maintenance and sharpening carried out at the site.

7. Milling tools represent locally available stones not shaped for subsequent use.

8. Lithic technology applied to obsidian differed from that applied to other cryptocrystalline (e.g. chert) and fine-grained volcanic materials (e.g. basalt).

C. Testing Mechanisms

1. Acquire an adequate sample of artifacts through a well-distributed sample of midden with adequate depth/stratigraphic controls.

2. Analyze various artifact categories and establish meaningful typologies based on previous regional work and qualitative and quantitative evaluation of site (artifact) content. Special attention will need to be paid to inferred manufacture processes.

3. Conduct experimental production of artifacts, if deemed appropriate.

IV. Trade/Exchange

The study region seemingly represents a peripheral trade area with respect to northern California as a whole. Ethnographically, some local trade and exchange occurred as between foothill/mountain and Valley groups and

between Yana groups themselves on a north to south basis.

A. Research Questions

1. What raw materials or products were obtained from non-local sources and what and where are the sources?

2. What groups may have traded with the local inhabitants? Why?

3. Were trade/exchange systems constant in the study region?

4. How do exchange/trade inferences based on data analysis relate to ethnographic patterns and historic events?

5. How do manufacture refuse and artifact frequencies relate to site activities? Are discrepancies explainable by trade/exchange?

B. Hypotheses

1. Trade/exchange (or contact-acquisition) will be evident through the presence of exotic materials or remains from distant or foreign (i.e. European) sources.

2. Trade/exchange/acquisition of exotic materials will be evident through the presence of finished or near-finished products and little or no manufacture refuse, and perhaps through the presence of certain European goods (i.e. glass beads).

3. Evidence of nonperishable manufactured goods for trade/exchange will not be present (e.g. numerous pestle blanks, basalt preforms, etc.).

4. Trade/exchange patterns of obsidian, shell beads, and other items will differ chronologically.

C. Testing Mechanisms

1. Obsidian hydration and sourcing.

2. Sourcing analysis of other potential exotic materials (e.g. pigments, chert, steatite).

3. Analysis of lithic manufacture techniques/refuse--or other material manufacture techniques/refuse--to assess possible blank or tool export-import.

4. Analysis of plant and animal remains for current or past distribution and availability from the sites' locality.

5. Comparison of tool kit and refuse patterns with other regional excavation results of similarly dated sites.

6. Adequately assess material and artifact types and frequencies by spatial and horizontal distribution.

V. Deposit Formation Processes

Site deposits in northern California invariably have formed through a combination of natural and cultural processes subject to human turbation of the midden/artifact, other bioturbation, downslope movement, water absorption and drying, and other events. What effects these various processes have on interpreting site occupation and past environments is an important line of inquiry.

A. Research Questions

1. What factors (anthropogenic and natural) have contributed to the structure and content of the deposits (tied in with soil studies)?

2. How much bioturbation has occurred?

3. Is there evidence of midden/artifact displacement by downslope movement, rain splash, etc.?

4. Is there evidence from the middens to indicate disturbance by subsequent site occupants?

5. What cultural disposal patterns are evident?

6. Has there been natural deposition/erosion at the sites?

7. Is there evidence of perishable preservation mechanisms (burning, dry areas, compartmentalization)?

8. Has bedrock, floor, wall, or ceiling disintegration affected the middens?

B. Hypotheses

1. Deposit formation represents an accumulation of downslope soil movement into the sides of one or more of the shelters, human refuse, disintegration of bedrock, vegetation remnants, and animal residues.

2. Human contribution to the deposit is minimal to moderate, at best, representing ephemeral activities over a short duration by a very mobile group.

3. No post-occupation human intrusions are present.

C. Testing Mechanisms

1. Examination of soil-midden content upon excavation for disturbance factors and natural content.

2. Examination of artifact sorting looking for natural (e.g. gravitational movement) as well as cultural factors as based on distribution within excavation levels and in the sites in general.

3. Proper recording of representative soil profiles.

4. Accurate surface mapping of site and immediate environs.

5. Definition of anomalies present in the midden (e.g. pits refilled, disposal zones, etc.).

6. Definition of midden contents, natural and cultural, through level observations and soil analysis throughout sampled midden.

7. Careful examination and definition of midden-sterile boundaries, if present.

Further Comments

The research topics, questions, and hypotheses, upon testing, have potential for gaining a greater understanding of the behavior and culture of the site's occupants and, to a lesser extent, regional peoples, depending on site content. More relevant questions, hypotheses, and testing mechanisms may become apparent with the initiation of excavation.

No doubt some, perhaps many of the questions and hypotheses, will prove unanswerable. This is probably the case in a testing phase. The proposed investigation strategy was a best guess at the time of project initiation. In any case, the preparation of the design makes the testing program responsive to the public and to the resource, however complex or simple, and can potentially allow for a greater extraction of the information present.

APPENDIX 2

BETA ANALYTIC INC.

MURRY A. TAMERS, PH.D.
JERRY J. STIPP, PH.D.
CO-DIRECTORS

4985 S.W. 74 COURT
MIAMI, FLORIDA
33155 U.S.A.

September 20, 1991

Dr. Eric W. Ritter
Bureau of Land Management
355 Hemsted Drive
Redding, CA 96002

Dear Dr. Ritter:

Please find enclosed the result on your charcoal sample recently submitted for radiocarbon dating analysis. We trust this date will be interesting for your work.

As before, the charcoal was pretreated by first examining for rootlets. It was then given our acid, alkali, acid series of soakings to remove carbonates and humic acids. The following benzene synthesis and counting went normally.

We are sending our invoice directly to your purchasing department for payment. As always, if there are any questions or if you would like to discuss the date, call us at any time.

Sincerely yours,

Murry Tamers

Murry Tamers, Ph.D.
Co-director

TELEPHONE: 305-667-5167 / FAX: 305-663-0964 / BITNET: XNRBET22@SERVAX

BETA ANALYTIC INC.
(305) 667-5167
UNIVERSITY BRANCH
P.O. BOX 248113
CORAL GABLES, FLA. 33124

REPORT OF RADIOCARBON DATING ANALYSES

OR: Eric W. Ritter

Bureau of Land Management

DATE RECEIVED: August 29, 1991

DATE REPORTED: September 20, 1991

SUBMITTER'S PURCHASE ORDER #

UR LAB NUMBER	YOUR SAMPLE NUMBER	C-14 AGE YEARS B.P. ± 1σ	
a-47055	CA-030-473	330 +/- 50 BP	(charcoal)

These dates are reported as RCYBP (radiocarbon years before 1950 A.D.). By international convention, the half-life of adiocarbon is taken as 5568 years and 95% of the activity of the National Bureau of Standards Oxalic Acid (original batch) used as the modern standard. The quoted errors are from the counting of the modern standard, background, and ample being analyzed. They represent one standard deviation statistics (68% probability), based on the random nature of the radioactive disintegration process. Also by international convention, no corrections are made for DeVries effect, eservoir effect, or isotope fractionation in nature, unless specifically noted above. Stable carbon ratios are measured on equest and are calculated relative to the PDB-1 international standard; the adjusted ages are normalized to -25 per mil arbon-13.

APPENDIX 3

ARCHAEOFAUNAL REMAINS FROM CA-TEH-1556, CA-TEH-1555, AND CA-TEH-1554, TEHAMA COUNTY, CALIFORNIA

By:
Nancy Valente

Archaeological Research Program
Department of Anthropology
California State University, Chico
Chico, California 95929

Prepared for:
Eric Ritter
United States Department of the Interior
Bureau of Land Management
355 Hemsted Drive
Redding, California 96002

Zooarchaeology Laboratory Report No. 92-12
January, 1992

Introduction

The purpose of this report is to identify and describe the archaeofauna from three rock shelters, CA-TEH-1556, CA-TEH-1555 and CA-TEH-1554, all located east of Red Bluff. Data from each rock shelter will be presented separately and will include a species list, a description of the identified fauna and the cultural modifications observed.

Method

All excavated material was screened with 1/4 inch mesh, with the exception of Unit B from CA-TEH-1554 which was screened with1/8 inch mesh, and Unit A, levels 10-20 cm and 20-30 cm, both of which were screened using 850 micrometer mesh. In addition to excavation, recovery techniques at CA-TEH-1556 included surface collecting and flotation. Faunal material from a rodent mound was also recovered.

Identification of the archaeofauna was accomplished using the comparative osteological collection at California State University, Chico. The goal was to identify each element to the taxonomic classification as specifically as allowable for each individual element. Mammals that were not identifiable to order, family, genus or species were placed in categories according to size, i.e. small mammal, small/medium, mammal, medium mammal, etc. Material which could not be identified to class level, i.e. mammal, bird, etc. was placed in the unidentifiable category. Other pertinent information was recorded for each element such as burning, butchering, weathering, carnivore or rodent chewing. All information was recorded by site, unit, and level.

CA-TEH-1556

Species List

Margaritifera spp. (Fresh water clam)
Leporidae (Rabbits & hares)
Spermophilus beecheyi (Beecheyi ground squirrel)
Sciuridae (Squirrel family)
Rodentia (Rodents)
Odocoileus hemionus (Mule deer)
Artiodactyl (Deer, pronghorn, elk)

Description of Fauna from CA-TEH-1556

One hundred thirty four fragments were examined from CA-TEH-1556. Figure 1. Mammals represent the most numerous group with 65 fragments (48%) while molluscs are represented by 15 fragments (11.2%). Fifty-four fragments were unidentifiable. In this site ten mammals were identifiable beyond class level, the most numerous group is Artiodactyl with 4 (40%), followed by rodents with three (30%), mule deer 2 (20%), and leporids 1 (10%). Of the 15 mollusc fragments only one was identifiable to genus level.

Mollusc remains were recovered from all three units of this site. Three small, thin shell fragments, all from level 0-10 cm, two in Unit A and one in Unit B, are lustrous and pearly in appearance. A gastropod, a mollusc that has a one piece, spirally coiled shell (Stratton 1968:16) is identified also in level 0-10 cm from Unit B. .The mollusc shell fragments identified from Unit C level 0-10 cm are distinctly different from those identified in Units A and B. These are dull in finish and more robust. Since more specific identification is not possible at this time the significance of these differences is unknown at present.

Material recovered through floation from level 10-20 cm of Unit B produced four very small mollusc shell fragments and one extremely tiny complete gastropod shell. Further identification of the gastropod is not possible at this time

The one small, thin shell fragment from level 20-30 cm, Unit A, is dull in appearance and the exterior of the shell exhibits concentric, closely spaced striations. The small shell fragment from level 30-40 cm, Unit A, is dull in appearance although a lustrous, pearly surface is visible where the exterior shell surface is absent.

The rodent mound testing produced one gastropod shell which appears to be from an ordinary garden variety snail whose presence at the site is assumed to be due to its life style.

One fused distal right calcaneus fragment, level 0-10 cm, Unit B, is identified as Leporid and compares favorably with a small *Lepus* spp. No cultural modifications are noted on this element.

Beecheyi ground squirrel is identified in level 30-40 cm, Unit A, from a distal humerus fragment. A mid-mandible fragment from level 20-30 cm, also in Unit A, identified as Sciurid, compares favorably with Beecheyi ground squirrel. No cultural modifications are noted on either fragment and it may be that the presence of these squirrels in the site is due to their intrusive habits.

One anterior rodent incisor fragment is identified in level 10-20 cm, Unit B. That rodents are indigenous to the area of CA-TEH-1556 suggests that their presence at this site is due to their natural life habits and range.

Mule deer is identified in levels 0-10 cm and 30-40 cm of Unit A. A complete upper left first premolar, which appears to be from a young mule deer, is present in the former level while a complete upper left second molar is identified from the latter level. Neither element shows evidence of cultural modification.

Artiodactyl is identified from one distal metapodial fragment and one tooth fragment, both in level 0-10 cm of Unit A. The metapodial fragment is heavily weathered and covered by a significant amount of concretion. A second artiodactyl tooth fragment is identified from level 0-10 cm of Unit B. This fragment is discolored and it is unknown if the discoloration is due to burning. A right distal tibia epiphysis from an artiodactyl is identified from the rodent mound testing. This element compares favorably with that of a young mule deer but the absence of the medial malleolus and the smaller size of the archaeofaunal element does not allow for a specific identification. No cultural modification is noted on this element.

Only one specimen was collected from the surface, a freshwater clam, *Margaratifera* spp. This animal favors cold, fast moving water such as found in the main channel of the Sacramento River (Eugster 1990:31).

Cultural modification

Evidence of burning is the only cultural modification recorded in Unit A and is noted on mammal bones that are identifiable only by size categories, all of which are located in level 0-10 cm. Figure 4. One long bone fragment from a small/medium mammal is calcined; four long bone shaft fragments and one rib fragment from medium/large mammals show evidence of burning as does two long bone shaft fragments from large mammals.

In Unit B, as in Unit A, cultural modifications are noted on mammal bone fragments that are identifiable only by size. One long bone shaft fragment of a small mammal from level 0-10 cm is calcined; a long bone shaft fragment from a small/medium mammal in level 10-20 cm, is also calcined; and one long bone shaft fragment of a large mammal from level 0-10 cm shows evidence of a spiral fracture and is partially discolored. The reason for discoloration is unknown at this time.

The only cultural modification noted in Unit C was one burnt bone fragment of a medium mammal from level 30-40 cm.

CA-TEH-1555

Species List

Crotalus viridis (Western rattlesnake)
Clemmys marmorata (Western pond turtle)
Odocoileus hemionus (Mule deer)
Artiodactyl (Deer, pronghorn, elk)

Description of fauna from CA-TEH-1555

Thirty-eight fragments were examined from CA-TEH-1555. Figure 2. Mammals constitute the most numerous group with 25 (65.8%), followed by nine reptiles (23.7%), two molluscs, and two

unidentifiable fragments. Only five mammals could be identified beyond the class level; mule deer is the most abundant identified mammal with four fragments (80%) with one Artiodactyl element completing the identified mammal contingent.

Molluscs are present in Unit B, identified from two small thin shell fragments, one each in levels 20-30 cm and 30-40 cm.

The Western rattlesnake is identified in level 30-40 cm of Unit B from one almost complete vertebra which possesses the enlongated haemal spine which is diagnostic for this species (Olsen 1971:2-11). The rattlesnake's diet consists of ground squirrels, rodents, smaller rabbits, as well as some birds and lizards, all animals indigenous to the area of CA-TEH-1555 (Storer & Usinger 1963:248). This suggests that the presence of the rattlesnake may be due to the life habit of the animal.

The Western pond turtle is identified from plastron fragments in Unit A: four in level 0-10 cm; three in level 20-30 cm; and one in level 30-40 cm. None of these fragments exhibit evidence of cultural modification. The Western pond turtle is the only turtle native to the California interior(Storer & Usinger 1963:239).

Four fragments from Unit A, level 20-30 cm form one left distal humerus shaft fragment of a mule deer. Generally a shaft fragment is insufficient for species identification. However, in this case species identification is possible due to the presence of the foramen on the posterior surface of the element. This element exhibits a spiral fracture and is blackened.

One artiodactyl metacarpal shaft fragment is identified in Unit A, level 0-10 cm. No cultural modification is observed on this element.

Cultural modification

Cultural modifications are recorded for bone fragments of mammals identified only by size. Medium/large mammal bone modifications are recorded for one burnt long bone shaft fragment, Unit A, level 30-40 cm; and two burnt long bone shaft fragments both from Unit B, one each in levels 10-20 cm and 20-30 cm. Modified large mammal fragments are noted in Unit A: four long bone shaft fragments from level 0-10 cm are burnt, three of which are calcined.

Burnt long bone shaft fragments of large mammals are also noted, one each in levels 10-20 cm and 20-30 cm of Unit A.

CA-TEH-1554

Species List

Coleoptera (Beetles)
Leporidae (Rabbits & hares)
Spermophilus beecheyi (Beecheyi Ground Squirrel)
Sciuridae (Squirrel family)
Peromyscus spp (White-footed mice)
Thomomys bottae (Pocket gopher)
Rodentia (Rodents)
Mephitis mephitis (Striped skunk)
Artiodactyl (Deer, pronghorn, elk)

Description of fauna from CA-TEH-1554

Forty-one fragments were examined from CA-TEH-1554. Figure 3. Mammals are the most numerous with 21 (51.2%), followed by six insects (14.6%), one bird, and 13 unidentifiable. Fourteen mammal elements were identifiable beyond the class level. Rodents constitute the most abundant identified mammal group, seven (50%), while leporids are the second most abundant mammal group with 4 (28.6%) while Artiodactyls are 2 (14.3%) and skunk is one (7.1%).

Insects are identified in Unit B in the upper two levels. Assistance in the identification of the elements was provided by Jay Bogiatto, biology instructor at California State University, Chico. Four exoskeleton elements are identified in level 0-10 cm, two thoracic shields and two abdomen with elytra. The latter compare favorably with Darkling ground beetles, family Tenebrionidae. Tenebrionids include more than 400 species in California, are an abundant and diverse species, and inhabit almost all terrestrial habitats (Powell & Hogue 1979:294). One puparium case is also identified from the same level, although it is unknown if it is from the Tenebrionid insects noted above. One beetle thoracic shield is identified in level 10-20 cm. The ubiquitous nature of beetles suggests that their presence at CA-TEH 1554 is due to their natural habits.

Four leporid elements are identified in level 0-10 cm from Unit A; one almost complete thoracic vertebra, two complete fused metatarsals, and one right tibia shaft fragment which compares favorably with *Sylvilagus* spp. The thoracic vertebra and metatarsals are calcined.

Rodents are numerous in this site. Beecheyi ground squirrel is identified from one fused right distal humerus fragment from Unit A, level 0-10 cm. One proximal left humerus fragment from Unit A, 10-20 cm, is identified as Sciurid and compares favorably with Beecheyi ground squirrel. The element is heavily weathered which makes it impossible to determine if the proximal epiphysis is absent due to the age of the animal or to taphonomic factors. *Peromyscus* spp. is identified in Unit B, level 10-20 cm, by a complete right mandible. The white-footed mouse genus is represented by many species and is the most widespread and common of all mammals in North America (Storrer & Usinger 1963:342). The pocket gopher is also identified from the same unit and level by an unfused right proximal femur.

Incisor fragments of rodents, one each in levels 0-10 cm and 10-20 cm, and one complete molar/premolar from level 10-20 cm, are identified from Unit B. A proximal fused left tibia fragment of a rodent from Unit A, 10-20 cm compares favorably with a Kangaroo rat. No cultural modification is noted on the above elements and the presence of the rodents at this site is probably due to their intrusive life ways.

Striped skunk is identified in Unit A, 0-10 cm, from one right anterior mandible fragment with a second premolar. The element is leeched, cracked, and calcined.

One tooth fragment and a complete left scaphoid from Unit A, 0-10 cm, are from Artiodactyls. The scaphoid compares favorably with a young mule deer and is very weathered, calcined, and exhibits a cut mark.

Cultural modification

In addition to the cultural modifications noted above only one additional modification is recorded from this site, that of a cut mark and a spiral fracture noted on one large mammal long bone shaft fragment from Unit B, 20-30 cm.

Conclusion

The fauna identified and described above for CA-TEH-1556, CA-TEH-1555, and CA-TEH-1554 are similar in species representation and represent animals that are indigenous to the areas in which the rock shelters exist. Except for those specimens that exhibit evidence of cultural modification, the evidence suggests that their presence at the site is due to the natural life habits of the animals. An exception to this generality must be noted for the presence of the freshwater clam and the Western pond turtle. Both these animals reside in water and the reason for their presence must be due to some action unrelated to their life style. A definitive interpretation of the data presented here is beyond the scope of this report.

Bibliography

Eugster, Susan E.
1990 *Freshwater Mussel Utilization at a Late Prehistoric Period Archaeological Site (CA-BUT-12) in the Northern Sacramento Valley*, California. Master's Thesis on file at CSUC.

Olsen, Stanley J.
1972 *Zooarchaeology: Animal Bones in Archaeology and their Interpretation.* Second Edition. Addison Wesley Publication Co., Inc.

Powell, Jerry A. & Charles L. Hogue
1979 *California Insects.* University of California Press: Berkeley.

Storer, Tracy I. & Robert L. Usinger
1963 *Sierra Nevada Natural History.* University of California Press: Berkeley.

Stratton, L.W.
1968 *Your Book of Shell Collecting.* Farber & Farber: London.

TABLE (FIGURE) 1
CA-TEH-1556 FAUNAL REMAINS

	UNIT A					UNIT B					UNIT C							
	0-10 CM	10-20	20-30	30-40	UNIT A TOTAL	0-10 CM	10-20	20-30	FLOT 10-20	UNIT B TOTAL	0-10 CM	10-20	20-30	30-40	UNIT C TOTAL	SURFACE COLL.	RODENT MOUND TEST.	SITE TOTAL
INVERTEBRATES																		
Margaritifera spp.																1		1
Gastropod						1			1	2							1	3
Mollusca	2		1	1	1	1			1	5	2				2			11
SUBTOTAL	2	0	1	1	1	2	0	0	5	7	2	0	0	0	2	1	1	15
VERTEBRATES																		
Leporidae						1				1								1
Spermophilus beecheyi				1	1													1
Sciuridae			1		1													1
Rodentia							1			1								1
Odocoileus hemionus	1			1	2													2
Artiodactyl	2				2	1				1							1	1
SUBTOTAL	3	0	1	1	6	2	1	0	0	3	0	0	0	0	1	1	1	10
MAMMAL Small						1			3	4								4
Small/Medium	6				6		1	1		1								7
Medium		1			1	1				1				1	1			3
Medium/Large	3		2	2	13	1	2			3								16
Large	6				1	2				2							1	8
Indeterminate Siz	1	1			1	2		1	5	13		1			1			10
Unidentifiable	6	6	2		14	10	3	2	18	33		1	2		3		1	54
TOTAL	31	9	9	5	51	26	2	3	31	67	2	2	2	1	7	1	8	134

TABLE (FIGURE) 2
CA-TEH-1555 FAUNAL REMAINS

	UNIT A					UNIT B					
	0-10 CM	10-20	20-30	30-40	UNIT A TOTAL	0-10 CM	10-20	20-30	30-40	UNIT B TOTAL	SITE TOTAL
INVERTEBRATES											
Mollusca								1	1	2	2
SUBTOTAL					0			1	1	2	2
VERTEBRATES											
Crotalus spp.									1	1	1
Clemmys marorata	4		3	1	8						8
Odocoileus hemionus			4		4						4
Artiodactyla	1				1						1
SUBTOTAL	5	0	7	1	13	0	0	0	1	1	14
MAMMAL											
Medium	2	3			8	1		1		2	7
Medium/Large				1	1		1	1		2	3
Large	4	2	1	1	8		1			1	9
Indeterminate Size								1		1	1
Unidentifiable	1				1			1		1	2
TOTAL	12	5	8	3	28	1	2	5	2	10	38

TABLE (FIGURE) 3
CA-TEH-1554 FAUNAL REMAINS

	UNIT A				UNIT B				
	0-10 CM	10-20	20-30	UNIT A TOTAL	0-10 CM	10-20	20-30	UNIT B TOTAL	SITE TOTAL
INVERTEBRATES									
Coleopetera					4	1		6	5
Insecta					1			1	1
SUBTOTAL				0	5	1		6	6
VERTEBRATES									
Leporidae	4			4				0	4
Spermophilus beccheyi	1			1				0	1
Peromyscus spp.				0		1		1	1
Thomomys bottae				0		1		1	1
Sciuridae		1		1				0	1
Rodentia		1		1	1	1		2	3
Mephitis memphitis	1			1				0	1
Artiodactyla	2			2				0	2
SUBTOTAL	8	2		10	1	3		4	14
Aves		1		1				0	1
Mammal									
Small			1	1	3			3	4
Small/Medium		1		1				0	1
Medium/Large	1			1				0	1
Large				0			1	1	1
Unidentifiable	6		3	9	1	3		4	13
TOTAL	15	4	4	23	10	7	1	18	41

TABLE (FIGURE) 4
MODIFICATION BY UNIT BY SITE

	CA-TEH-1554				CA-TEH-1555				CA-TEH-1556					
	UNIT A		UNIT B		UNIT A		UNIT B		UNIT A		UNIT B		UNIT C	
	Burn	Butch	Burn	Butch	Burn	Butch	Burn	Butch	Burn	Butch	Burn	Butch	Burn	Butch
Leporidae	3	0												
Memphitis mephitis	1	0												
Odbcoileus hemionus					1	1								
Artiodactyla	1	•									1-OC			
MAMMAL														
Small											1			
Small/Medium											1			
Medium													1	
Medium Large					1		2		5					
Large				1	6				2		1-OC	1		
TOTAL	5	1	4	1	8	1	2	0	7	0	4	1	1	0

APPENDIX 4

CHARRED PLANT MACROFOSSILS FROM TEH-1555 AND TEH-1556

Eric Wohlgemuth

Prepared for the Bureau of Land Management

355 Hemsted Drive

Redding, California

In fulfillment of:

Order No. B-050-P1-0222

Requisition No. B-0590RQ1-130

November, 1991

CHARRED PLANT MACROFOSSILS FROM TEH-1555 AND TEH-1556

Eric Wohlgemuth

Introduction

One soil sample each was collected and flotation-processed from TEH-1555 and TEH-1556, two small rockshelters with sparse deposits of cultural material in Antelope Creek Canyon east of Red Bluff, Tehama County. The sample from TEH-1555 was collected from Unit A, 20-30 cm, and comprised 5.5 liters of soil, while the sample from TEH-1556 was collected from Unit B, 10-20 cm, comprising 8.5 liters of soil. Comparative archaeobotanical data from several open midden sites from Redding, the Cottonwood Creek basin, and the upper Sacramento area permit evaluation of the scant seed remains found in the current sites.

Processing Methods

Flotation was performed by Michael Darcangelo, following procedures used with hundreds of soil samples throughout northern California (Wohlgemuth 1991). Flotation took place in a large washtub to which water and soil were added and mixed. Plant materials were skimmed off the top, and then decanted through 40/inch mesh from the dense heavy fraction. The tub was refilled and the process repeated two more times before heavy fraction was washed through 1/8" and window meshes (18 x 16 mesh/inch, = approximately 1.0 mm). Light fraction was allowed to dry overnight in shade, while heavy fraction was sun-dried. When dry, light fractions were gently passed through 1.75 mm, 1.0 mm, and 0.7 mm mesh to facilitate analysis. Material larger than 1.75 mm was sorted with the naked eye, and segregated constituents were checked at 10X magnification with a binocular microscope. The 1.0 mm and 0.7 mm grades were sorted at 10X, while material smaller than 0.7 mm was not sorted. Heavy fractions were not examined, but recent work has shown that mean recovery of large seeds typical of the northern Sacramento Valley foothills ranges from 63% to 93% using this technique (Wohlgemuth 1991).

Descriptive Inventory

Consistent with the sparse cultural remains found at the two sites is a sparse charred seed assemblage (Tables 1 and 2). Seed remains were identified to only three genera and one additional plant family. Acorn nutshell, found in minute quantities in the TEH-1556 sample, is most likely that of the genus Quercus (oak); although Castanopsis sempervirens (chinquapin) and Lithocarpus densiflora (tan oak) are similar, they are montane species not occurring at low elevations. Acorn nutshell has been found in all sites investigated to date in Shasta County (Wohlgemuth 1991). No attempt was made to identify acorn remains to species, but the most likely candidates are the local foothill species, Quercus douglasii (blue oak), and Q. wislizenii (interior live oak). Acorns were the primary plant food staple of California Indians (Kroeber 1925:814). Acorns, gathered in the fall, were shelled, pounded, and made into thick soups or bread. Acorn bread and unshelled acorns could be stored for months (DuBois 1935:18-19). In addition to the four fragments identified as acorn nutshell at TEH-1556, there are a few undifferentiated nutshell fragments from each site which were not identified. It is possible that some of these may also be acorn.

TABLE 1. TEH-1555 and TEH-1556 Seed Remains.

	TEH-1555	TEH-1556
Sample volume (liters)	5.5	8.5
Acorn nutshell*		
number	--	4
mg	--	1.4
Undifferentiated nutshell		
number	2	2
mg	1.1	2.1
Bedstraw (*Galium* sp.)	3	19
Clover (*Trifolium* sp.)	--	1
Grass caryopses	1	1
Unidentified seeds	--	2
Total small seeds	4	23

* Sorted to 0.7 mm.

TABLE 2. Density of Seed Remains from TEH-1555 and TEH-1556.

	TEH-1555	TEH-1556
Acorn nutshell*		
number	--	0.5
mg	--	0.2
Undifferentiated nutshell		
number	0.4	0.2
mg	0.2	0.2
Bedstraw (*Galium* sp.)	0.5	2.2
Clover (*Trifolium* sp.)	--	0.1
Grass caryopses	0.2	0.1
Unidentified seeds	--	0.2
Total small seeds	0.7	2.7

* Sorted to 0.7 mm.

Seed of bedstraw (Galium sp.) is the most abundant seed taxon found in each sample. Bedstraw was the most abundant small seed taxon found at SHA-1588, but was accompanied there by abundant manzanita and small amounts of gray pine and acorn nutshell. Bedstraw seed has been recovered in smaller numbers at several other sites in Shasta County (Wohlgemuth 1991). Bedstraw seeds have not been described as used by native northern Californians. Medicinal and magical uses are noted for leaves or unspecified plant parts by some sources (Bocek 1984; Duncan 1963; Schenck and Gifford 1952). At SHA-1175 north of Lakehead, bedstraw was most abundant in a late structure, and a tentative interpretation of bedding there was offered (Wohlgemuth 1989:17). It is tempting to speculate that a similar use was made of bedstraw in the interior of rockshelters TEH-1555 and TEH-1556.

A single clover seed (Trifolium sp.) was found in the TEH-1556 sample. Clover seed has been found in small numbers in virtually all previous Shasta County archaeobotanical investigations (Wohlgemuth 1991). Clover is well-described as an important source of greens after long winters spent eating stored foods (Barrett and Gifford 1933; Bocek 1984; Chesnut 1902; Duncan 1963). Some seed consumption is reported (Chesnut 1902; Goldschmidt 1951), but clearly this was secondary to the greens.

Two grass caryopses (= seeds) were noted, one from each sample. The specimen from TEH-1555 may be a member of the Panicoideae tribe, while a badly degraded, unidentifiable fragment was found at TEH-1556. Use of grasses is poorly documented in California ethnobotanies, deriving more likely from the absence of data than of lack of use, as grass caryopses are almost invariably abundant in California archaeological contexts wherever small seeds are well preserved.

Three unidentified seeds were noted, all from TEH-1556. Two may be in the carrot family (Apiaceae). Interestingly, no seed fragments were found other than the grass caryopsis at TEH-1556; seed fragments are ubiquitous in the rich seed assemblages found in larger sites in Shasta County. Finally, although wood charcoal identification was not attempted, it should be noted that wood charcoal is relatively common in the light fractions of each sample.

Discussion

Given the presence of wood charcoal in some quantity in each sample, it appears that conditions were good for the preservation of plant macrofossils. In this light, it is interesting that seed remains have been preserved in such low frequency. This is counter to the numerous open midden sites which have been examined elsewhere in Shasta County, all of which contain seed remains, usually in dense accumulation. It is possible that we have skewed samples of the plant remains, inasmuch as only one sample was collected at each rockshelter, and considerable artifact assemblage divergence can be expected, for example, within and outside the drip line. Furthermore, substantial intrasite variation in seed frequency has been shown in middens in Redding. However, variation noted is in quantity of materials, and the absence of less common seed taxa in certain proveniences at SHA-47, SHA-222, and SHA-236 (Wohlgemuth 1990; 1991) can be explained as a predictable consequence of lower frequencies of all plant materials (cf. Jones, Grayson, and Beck 1983). Virtually every flotation sample processed from open Shasta County middens, however marginal, contains manzanita

berry nutlets, gray pine nutshell, and acorn nutshell. Similarly, small seeds are usually common, and often abundant and diverse, in open sites. Several species found abundantly in the lowland midden sites also occur in the vicinity of the sites, particularly manzanita, gray pine, and oaks. Hence it seems unlikely that the absence of such ubiquitous seeds can be explained by sampling error alone.

Several alternative explanations can be posed for the dearth of seed remains at TEH-1555 and TEH-1556. First, it is possible that the sites were occupied when seeds remains typically found in middens were not gathered and processed. This would most likely be prior to or after the period from summer to fall, when most plant foods ripen in lowland California. The millingstones found in each shelter, however, give credence to the use of plant foods, unless they were used exclusively for grinding small animals. Second, seeds may have been consumed by not deposited archaeologically due to different taphonomic processes. For example, different plant processing strategies may have been employed at the shelters than in open sites, such as seed parching prior to grinding and cooking. The presence of seeds, albeit in minute amount, indicates that seed remains were deposited as part of the cultural deposit.

Third, the sites could have been used by groups not processing plant materials, such as small hunting parties. This seems unlikely given the millingstones found, usually assumed to indicate the inclusion of women in the social group. Similarly, the use of fire may have been limited, to such purposes as heating and perhaps cooking game, rather than processing plant foods. Lastly, the impoverished artifact assemblage may be the interpretive key. Occupation of the shelters may have been so ephemeral that there was insufficient use of plant food resources to deposit them in quantity. The accumulation of charred seed remains may be a function of occupation duration, where the length of stay gives rise to repetitive processing, resulting in the accumulation of debris "in the way" useful for fuel, and in inevitable spills and accidents, which lead to deposition in quantity. Given the sparseness of occupation debris in the sites, this last scenario seems the most likely.

Conclusion

Flotation of single samples of midden deposit from rockshelters TEH-1555 and TEH-1556 has yielded seed assemblages quite different from several open sites in Shasta County. Charcoal is common, indicating good preservation of plant macrofossils, yet seed remains are nearly absent. Of the alternative interpretations offered to explain this pattern, the most economical relies on the sparseness of other types of cultural material, arguing that seed remains should be rarely deposited in sites occupied for such short duration.

The aberrant assemblages from the two rockshelter samples in contrast to open occupation sites suggest that additional rockshelters in this portion of the southern Cascade foothills warrant soil sample collection and flotation processing.

Literature Cited

Barrett, S.A., and E.W. Gifford
1933 Miwok Material Cultural. Bulletin of the Milwaukee Public Museum 2(4):117-376.

Bocek, B.R.
1984 Ethnobotany of Costanoan Indians, California, Based on Collections by John Harrington. Economic Botany 38(2):240-255.

Chesnut, V.K.
1902 Plants Used by the Indians of Mendocino County, California. Contributions from the U.S. National Herbarium 7:294-422.

DuBois, C.A.
1935 Wintu Ethnography. University of California Publications in American Archaeology and Ethnology 36(1):1-148.

Duncan, J.W.
1963 Maidu Ethnobotany. Unpublished M.A. Thesis, California State University, Sacramento.

Jones, G.T., D.K. Grayson, and C. Beck
1983 Artifact Class Richness and Sample Size in Archaeological Surface Assemblages. In: Lulu Linear Punctated: Essays in Honor of George Irving Quimby, edited by R.C. Dunnell and D.K. Grayson. University of Michigan Museum of Anthropology Anthropological Papers 72:55-73.

Kroeber, A.L.
1925 Handbook of the Indians of California. New York: Dover Publications.

Schenck, S.M., and E.W. Gifford
1952 Karok Ethnobotany. University of California Anthropological Records 13(6).

Wohlgemuth, Eric

1989 Floral Remains from SHA-1588 and SHA-1544, Appendix. IN Archaeological Investigations at Flat Creek, CA-SHA-1588, Shasta County, California, by M. Kowta and W.R. Dreyer. Report prepared for the Bureau of Land Management, Redding.

1990 Floral Remains from Flotation Samples, Chapter 8. In Archaeological Investigations at CA-SHA-222, Riverbend Estates, Redding, Shasta County, California, by T. Vaughan. Ms. on file Northeast Information Center, Department of Anthropology, California State University, Chico.

1991 Floral Remains from Flotation Samples, Chapter 8. In Archaeological Investigations at CA-SHA-47 and CA-SHA-236, Redding, Shasta County, California. Ms. on file Northeast Information Center, Department of Anthropology, California State University, Chico.

APPENDIX 5

Artifact Classification (Morphology), Definitional Criteria, and Lithic Terminology

Alternate Flake (ALT)

A flake that is much wider than long, triangular in cross-section, and produced as a result of creating a bifacial edge from a square edge on a given piece of stone (Flenniken 1987).

Arris

A centralized ridge on the dorsal surface of a flake or retouched tool.

Bipolar Flake (BIP)

A flake which is the product of a reduction strategy in which the parent material receives opposing force to its proximal and distal ends through the use of a percussive instrument and an anvil. Flakes are generally blocky in form, and often exhibit crushed opposable platforms with a sheared bulb of force.

Bulbar Flake (BULB)

A percussion thinning flake removed from the proximal end of the ventral surface of a flake blank. This flake removes the contact point (platform area), cone, and most of the bulb of percussion from the flake blank (Flenniken 1987).

Cobble

Lithic material which exhibits only very minor modification and maintains no less than 99% total cortex.

Core

A nucleus, a mass of material often preformed by the worker to the desired shape to allow the removal of a definite type of flake or blade. Cores are pieces of isotrophic toolstone which exhibit one or more negative flake or blade scars. Cores may be embryonic, such as a piece of natural, unprepared material with a single scar. More often, however, cores exhibit multiple, patterned flake removal scars from one or more platforms, the creation of which shapes the piece into discrete morphological types (i.e. initially struck, single, multiple, rotated, opposed, or bipolar platform cores). Cores play an important and integral role in the study of lithic assemblages. By their very nature, cores represent the first stage in a technological sequence producing materials to be employed for the manufacture and use of flaked stone tools (adapted from Crabtree 1982 and Nilsson 1988).

Cortex

Outer weathered rind on lithic material, or naturally occurring rind on the outside of lithic material.

Cortical Rind Flake (also Wedge, Orange Wedge, Orange Slice) (CORT/WDG)

A distinctive type of linear shatter said to be a modified bipolar percussive procedure. Often both dorsal and ventral surfaces display negative flake scars, thereby making the determination of a dorsal and/or ventral side difficult. Thickness of the specimens varies greatly. Often triangular in view, most often thin and flat with one feather-terminated margin and an opposing or adjacent margin displaying a band of cortex. The striking platform of the flake is set at a ninety-degree angle (perpendicular) to the cortical area. Cortex covers the smooth round portion of the specimen and is denoted as either having a straight, minimal cortical area, or a cortical area which forms a ninety-degree curvature in which the cortical length is up to 50% longer on one side (Tyree 1992).

Debitage

Debitage is defined as unmodified, residual lithic flakes and shatter produced from the reduction of parent pieces (i.e. cores, flakes) or from the manufacture of flaked stone tools. Debitage can represent one or more stages of reduction of the raw material from the original form to the finished stage (Crabtree 1982, Nilsson 1988).

Identifiable Debitage

Debitage is considered to be "identifiable" when flakes exhibit complete platforms and when greater than 50% of their termination and margins are intact.

Unidentifiable Debitage

This classification is defined as those flakes with a missing and/or broken platform, thus rendering the platform indistinguishable. A flakes is also considered unidentifiable when it is missing greater than 50% of its margins or terminal end.

Dorsal

Surface of a flake corresponding to the exterior of the artifact from which it was detached.

Early Stage Bifacial Thinning Flake (EBTF)

A percussion flake removed from a biface during secondary reduction activities. These exhibit few dorsal scars, are slightly curved or twisted in long section, have single-faceted or multi-faceted platforms, and are usually the largest thinning flakes produced during biface manufacture. These flakes are produced as a result of making large bifaces symmetrical (adapted from Flenniken 1987).

Early Stage Core Reduction Flake (ECR)

A percussion flake removed from a core during primary reduction activities. These exhibit few dorsal scars, are straight in long section, and have a single faceted platform which exhibits a smooth, flat, planar surface (Nilsson 1988).

Early Stage Pressure Flake (EPR)

A flake removed as part of the first series of pressure flakes taken off a biface. These have multiple scars on their dorsal surface, are twisted in long section, are small, and exhibit platforms with oblique angles. These flakes result from regularizing a bifacial edge by pressure flaking (Nilsson 1988).

Edge-Modified Piece (also Edge-Modified Flake)

This artifact category includes flakes or blades which exhibit alteration of their natural edge(s) by minimal, intentional flaking or by use resulting in edge attrition. Specimens are classified as edge-modified pieces only if they lack distinct morphological attributes necessary for inclusion into other flake tool types such as unifaces or bifaces (Nilsson 1988).

Edge Preparation Flake (EPREP)

A flake removed from the edge of a flake blank in order to prepare or rejuvenate the blank for further reduction. The original dorsal surface of the blank serves as the platform of these flakes. The original detachment scar is visible on the distal end of the dorsal surface of these flakes (Flenniken 1987).

Edge Removal Flake (EREM)

These flakes are half-moon shaped fragments of a bifacial edge, produced as mistakes when the knapper strikes the biface too hard and too far from the margin (Nilsson 1988).

Eraillure Flake (ERAIL)

An enigmatic flake formed between the bulb of force and the bulbar scar. The eraillure flake, itself, leaves no scar on the core. The dorsal side of the eraillure flake bears no compression rings but the ventral side does bear compression rings that match the scar left on the bulb of force (Crabtree 1982).

Late Stage Bifacial Thinning Flake (LBTF)

A flake produced during the final stages of percussion flaking. These have numerous scars on their dorsal surfaces, are almost flat in long section, usually exhibit feather terminations, and have multi-faceted platforms (Flenniken 1987).

Late Stage Core Reduction Flake (LCR)

A percussion flake removed from a core during primary or secondary activities. These exhibit few dorsal scars, are straight to semi-curved in long section, and generally have a single faceted platform which exhibits a

smooth, slightly angled planar surface.

Late Stage Pressure Flake (LPR)

A flake produced during the final pressure flaking episodes. These are small, parallel-sided flakes with one dorsal arris, are slightly twisted in long section, and have multi-faceted, abraded platforms (Nilsson 1988).

Notch Flake (NTCH)

A pressure flake with the platform situated in a depression and fan-shaped in plan view. These flakes are produced as a result of manufacturing a notch in a biface (Flenniken 1987).

Overshot Flake (also Outrepasse) (OSHT)

A term that refers to flakes that have their platform as one edge of the biface. The other edge of the flake is the opposite margin of the biface. A flake that travels across the entire biface, from margin to margin (Flenniken 1987).

Primary/Initial Stage Decortication Flake (PRI)

A flake which possesses cortex over 100% of its dorsal surface.

Projectile Point (also Arrowhead)

A distinct category of bifaces (see Biface) which displays shouldering, notching, and/or hafting characteristics.

Retouched Toolstone

Retouched tools are flaked stone artifacts which exhibit purposeful, secondary modification along one or more of their margins. Modification can result from either extensive percussion or pressure flaking applied in one or more stages, or simply from using a previously unmodified edge. Retouched tools evolve through a series of progressively refined flaked stage forms which ultimately lead to the desired end product. They are commonly classified by means of typological and technological analyses in an attempt to define an artifact's function and range of variability. This grouping often includes gravers/drills, edge-modified pieces, unifaces (including scrapers), bifaces (non-hafted and non-shouldered pieces), and projectile points (hafting, shouldering, and/or notching present).

Shatter (also Angular Shatter) (SHATT)

Angular pieces of material with multiple flake removals that exhibit no distinguishable platforms or terminations.

Unidentifiable Flake Fragment (UNF)

Flakes with a missing and/or broken platform which renders the platform unrecognizable. A flake is also considered unidentifiable if greater than 50% of its termination or margin(s) is missing.

Uniface

Unifaces are formally shaped artifacts with invasive retouch that extends across only one face of the specimen. Artifacts are included in this category only if they lack sufficient morphological attributes necessary for placement into other tool type categories (ex: unifacial knives or projectile points). Although often resembling edge-modified pieces, being fashioned on flake blanks and exhibiting edge modification on one face, unifaces differ from these artifacts in two important ways: (1) unifaces are characterized by purposeful, invasive retouch which covers at least 50% of the worked face (note that edge-modified pieces exhibit only marginal edge modification which may result from use and not intentional thinning and shaping) and, (2) unifaces are often more shaped than edge-modified pieces, the latter often reflecting simple, and perhaps, casual use (Nilsson 1988).

Ventral

The interior surface of a flake which often displays the bulb of percussion and compression rings.

Glossary References Cited

Crabtree, D.E.
1982 An Introduction to Flintworking (Second Edition). Idaho State University Museum, Occasional Paper 28, Pocatello, ID.

Flenniken, J.J.
1987 The Lithic Technology of the East Lake Site, Newberry Crater, Oregon. Report prepared for USDA/Forest Service, Deschutes National Forest, Bend, OR.

Nilsson, E.
1988 Flaked Stone Artifacts from CA-Men-2138. Draft report submitted to PAR & Associates, Sacramento, CA.

Tyree, K. D.
1992 Debitage Variation as a Measure of Adaptive Strategy: A Study of Three Lithic Assemblages from Shasta County, California. Master's thesis, Department of Anthropology, California State University, Chico, CA.

APPENDIX 6

IDENTIFIABLE DEBITAGE-RAW DATA

Key: Unt = Unit Co = Cortex
Dep = Depth/Level De = Debitage Type
Cat = Catalog # Wht = Weight (gm)
Mat = Material Type Gr = Grid/Size Range (mm)

CA-TEH-1554 B&B Rockshelter

Unt	Dep	Cat	Ma	Co	De	Wht	Gr
A	010	455-1	03	01	01	35.8	65
A	010	455-1	03	01	02	0.2	12
A	020	455-5	03	01	02	1.4	30
A	020	455-5	02	01	01	1.1	16
A	020	455-5	03	01	02	18.4	55
A	020	455-5	03	01	02	0.3	18
A	020	455-5	03	01	02	4.7	28
A	020	455-5	03	01	02	3.2	28
A	020	455-5	03	01	02	2.4	30
A	020	455-5	03	01	02	7.3	38
A	020	455-5	03	02	14	0.3	00
A	020	455-5	03	02	14	0.2	00
A	020	455-9	03	01	10	0.1	08
A	020	455-9	03	02	14	0.1	00
A	030	455-10	03	01	17	1.3	20
A	030	455-10	03	02	14	0.2	00
A	030	455-12	03	01	10	1.0	06

CA-TEH-1555 Blue Dick Rockshelter

unt	dep	cat	ma	co	de	wht	gr
A	010	454-2	01	01	03	0.3	14
A	010	454-2	01	01	04	0.1	10
A	010	454-2	01	01	04	0.1	14
A	010	454-2	01	01	04	0.2	14
A	010	454-2	01	01	04	0.2	14
A	010	454-2	01	01	04	0.1	12

A	010	454-3	03	01	02	29.5 66
A	010	454-3	03	01	02	4.5 32
A	010	454-3	03	01	02	7.4 36
A	010	454-3	03	01	02	0.2 14
A	010	454-3	03	01	02	0.2 14
A	010	454-3	03	01	03	1.5 30
A	010	454-3	03	01	01	1.5 24
A	010	454-3	03	01	03	0.4 14
A	010	454-3	03	01	03	0.4 14
A	010	454-3	03	01	03	0.1 10
A	010	454-3	03	01	03	1.4 26
A	010	454-3	03	01	03	0.8 24
A	010	454-3	03	01	02	3.1 30
A	010	454-3	03	01	02	1.1 26
A	010	454-3	03	01	02	6.3 34
A	010	454-3	03	01	02	0.3 14
A	010	454-3	03	01	02	5.0 46
A	010	454-3	03	01	02	1.3 22
A	010	454-3	03	01	02	0.1 16
A	010	454-3	03	01	02	0.2 14
A	010	454-3	03	01	02	0.2 14
A	010	454-3	03	01	02	0.2 14
A	010	454-3	03	01	02	1.5 26
A	010	454-3	03	01	02	1.0 24
A	010	454-6	03	01	03	152. 85
A	020	454-7	03	01	02	16.6 52
A	020	454-7	03	01	02	4.0 36
A	020	454-7	03	01	02	4.2 36
A	020	454-7	03	01	02	0.6 22
A	020	454-7	03	01	03	7.6 48
A	020	454-7	03	01	02	3.2 30
A	020	454-7	03	01	02	14.6 52
A	020	454-7	03	01	02	25.0 55
A	020	454-7	03	01	01	5.7 32
A	020	454-8	01	01	02	0.3 14
A	020	454-8	01	01	03	0.2 12
A	030	454-11	03	01	02	7.7 38
A	030	454-11	03	01	02	1.8 28
A	030	454-11	03	01	03	2.2 30
A	030	454-11	03	01	03	3.5 30
A	030	454-11	03	01	02	23.7 60
A	030	454-11	03	01	01	5.4 40

```
A     030 454-11  03 01 03 5.0   38
A     030 454-12  01 01 02 0.3   16
A     030 454-12  01 01 03 0.1   14
A     030 454-12  01 01 03 0.3   16

A     040 454-14  03 01 02 3.1   30
A     040 454-14  03 01 02 1.4   24

B     010 454-20  03 01 02 1.1   22
B     010 454-20  03 01 02 0.3   14
B     010 454-20  03 01 02 0.8   20
B     010 454-20  03 01 01 104.  90
B     010 454-20  03 01 01 0.2   12
B     010 454-20  01 01 01 0.4   14
B     010 454-20  03 01 02 0.2   16
B     010 454-20  03 02 14 0.3   00
B     010 454-20  03 01 02 37.0  65
B     010 454-20  03 01 02 0.5   18
B     010 454-20  03 01 02 29.4  68
B     010 454-21  01 01 02 0.3   14
B     010 454-21  01 01 03 1.8   24
B     010 454-21  01 01 03 0.2   14
B     010 454-21  01 01 03 0.1   14

B     020 454-24  03 01 02 43.4  65
B     020 454-24  03 01 02 36.6  50
B     020 454-24  03 01 02 8.5   48
B     020 454-24  03 01 03 22.2  50
B     020 454-24  03 01 02 161.  98
B     020 454-24  03 01 02 4.9   38
B     020 454-24  03 01 02 1.0   26

B     030 454-26  03 01 03 4.8   36
B     030 454-26  03 01 04 0.1   14
B     030 454-26  03 02 14 1.6   00

B     040 454-29  03 01 02 4.4   32


Aflt  030 1555    01 01 06 0.1   06
Aflt  030 1555    03 01 10 0.1   06
Aflt  030 1555    03 01 10 0.1   06
Aflt  030 1555    01 01 10 0.1   06
Aflt  030 1555    03 01 04 0.1   06
```

Aflt	030	1555	01	01	06	0.1	06
Aflt	030	1555	03	01	04	0.1	08

CA-TEH-1556 Pipevine Rockshelter

Unt	Dep	Cat	Ma	Co	De	Wht	Gr
A	010	473-1	03	01	01	4.7	38
A	010	473-1	03	01	01	9.8	52
A	010	473-1	03	01	01	1.0	24
A	010	473-1	03	01	01	0.3	16
A	010	473-1	03	01	01	46.1	70
A	010	473-1	03	01	03	0.7	22
A	010	473-1	03	01	02	2.2	28
A	010	473-1	03	01	02	3.7	26
A	010	473-1	03	01	02	8.5	34
A	010	473-1	03	01	02	1.9	24
A	010	473-1	03	01	02	3.8	30
A	010	473-1	03	01	02	13.5	60
A	010	473-1	03	01	02	0.2	16
A	010	473-1	03	01	02	0.1	14
A	010	473-1	03	01	02	6.1	36
A	010	473-1	03	01	02	11.9	54
A	010	473-1	03	01	02	72.7	82
A	010	473-1	03	01	02	14.2	60
A	010	473-1	03	01	03	13.9	50
A	010	473-1	03	01	03	44.8	70
A	010	473-1	03	01	03	2.5	28
A	010	473-1	03	01	03	9.6	46
A	010	473-1	03	01	03	17.9	60
A	010	473-1	03	01	03	2.5	30
A	010	473-1	03	01	03	1.4	30
A	010	473-1	03	01	03	9.6	38
A	010	473-1	03	02	14	0.4	00
A	010	473-1	03	01	04	1.4	28
A	010	473-1	03	01	04	1.9	34
A	010	473-1	03	01	04	0.2	18
A	010	473-1	03	02	14	1.3	00
A	010	473-11	01	01	01	0.3	16
A	010	473-11	01	01	02	0.2	16
A	010	473-11	01	01	02	0.1	12
A	010	473-11	01	01	10	0.1	06

A	020	473-14	03	01	03	0.6	20
A	020	473-14	03	01	01	1.0	22
A	020	473-14	03	01	02	0.8	20
A	020	473-14	03	01	02	4.3	36
A	020	473-14	03	01	02	2.3	28
A	020	473-14	03	01	02	5.7	46
A	020	473-14	03	01	02	21.9	60
A	020	473-14	03	01	02	18.1	65
A	020	473-14	03	01	02	1.1	22
A	020	473-14	03	01	03	7.9	38
A	020	473-14	03	01	03	2.9	30
A	020	473-14	03	01	03	0.8	22
A	020	473-14	03	01	04	0.7	20
A	020	473-14	03	01	03	0.3	14
A	020	473-14	03	01	03	0.2	14
A	020	473-14	03	01	04	3.3	36
A	020	473-14	03	01	04	0.4	22
A	030	473-18	03	01	02	2.6	32
A	030	473-18	03	01	01	16.9	48
A	030	473-18	03	01	02	74.4	65
A	030	473-18	03	01	02	12.7	52
A	030	473-18	03	01	02	9.2	48
A	030	473-18	03	01	02	7.9	40
A	030	473-18	03	01	02	2.2	30
A	030	473-18	03	01	02	1.1	28
A	040	473-22	03	01	02	4.7	42
A	040	473-22	03	01	01	3.1	28
A	040	473-22	03	01	01	1.5	26
A	040	473-22	03	01	02	2.0	26
A	040	473-22	03	01	02	3.6	38
A	040	473-22	03	01	02	2.5	32
A	040	473-22	03	01	02	2.0	26
A	040	473-22	03	01	02	0.8	20
A	040	473-22	03	01	02	0.6	18
A	040	473-22	03	01	02	0.4	18
A	040	473-22	03	01	03	85.4	70
A	040	473-22	03	02	14	2.3	00
A	020	473-23	01	01	01	0.2	12
A	020	473-23	01	01	08	0.9	22
A	020	473-23	01	01	17	0.3	14

A	040	473-24	01	01	01	3.9	22
A	040	473-24	01	01	02	0.1	12
B	010	473-29	03	01	02	9.0	50
B	010	473-29	03	01	02	18.6	58
B	010	473-29	03	01	02	0.9	26
B	010	473-29	03	01	02	38.3	60
B	010	473-29	03	01	02	17.1	52
B	010	473-29	03	01	02	15.9	65
B	010	473-29	03	01	02	4.1	30
B	010	473-29	03	01	02	5.5	34
B	010	473-29	03	01	02	38.5	65
B	010	473-29	03	01	02	24.1	56
B	010	473-29	03	01	02	22.4	55
B	010	473-29	03	01	02	7.8	38
B	010	473-29	03	01	02	3.3	28
B	010	473-29	03	01	02	1.4	36
B	010	473-29	03	01	02	0.4	20
B	010	473-29	03	01	02	4.8	34
B	010	473-29	03	01	02	2.4	30
B	010	473-29	03	01	04	0.2	18
B	010	473-29	03	01	02	2.5	38
B	010	473-29	03	01	02	1.2	26
B	010	473-29	03	01	02	3.3	36
B	010	473-29	03	01	02	1.3	24
B	010	473-29	03	01	08	9.4	65
B	010	473-31	01	01	03	0.1	14
B	010	473-31	01	01	02	0.2	14
B	010	473-31	01	01	02	0.6	20
B	010	473-31	01	01	02	0.8	20
B	010	473-31	01	01	03	0.1	14
B	010	473-31	01	01	03	0.1	14
B	010	473-31	01	01	03	0.3	16
B	010	473-31	01	01	03	0.2	14
B	010	473-31	01	01	03	0.1	14
B	010	473-31	01	01	03	0.1	12
B	010	473-31	01	01	04	0.2	14
B	010	473-31	01	01	03	0.2	12
B	010	473-31	01	01	04	0.1	12
B	010	473-31	01	01	04	0.1	12
B	010	473-31	01	01	04	0.1	12
B	010	473-31	01	01	02	1.1	22
B	010	473-31	01	01	17	0.1	12
B	010	473-31	01	01	01	0.2	12

B	010	473-31	01	01	01	0.7	18
B	010	473-31	01	01	01	0.2	14
B	010	473-31	01	01	01	0.2	16
B	010	473-31	01	01	02	0.6	20
B	010	473-31	01	01	02	0.5	16
B	020	473-35	03	01	02	3.3	38
B	020	473-35	03	01	02	4.6	36
B	020	473-35	03	01	02	7.8	46
B	020	473-35	03	01	02	0.4	16
B	020	473-35	03	01	01	26.4	68
B	020	473-35	03	01	02	0.6	20
B	020	473-35	03	01	02	0.2	14
B	020	473-35	03	01	02	1.3	30
B	020	473-35	03	01	02	0.5	22
B	020	473-37	01	01	01	0.6	20
B	020	473-37	01	01	03	0.2	14
B	020	473-37	01	01	04	0.4	16
B	020	473-37	01	01	01	0.7	24
B	030	473-42	03	01	02	53.9	70
B	030	473-42	03	01	02	6.8	38
B	030	473-42	03	01	02	3.8	36
B	030	473-42	03	01	02	1.3	18
B	030	473-42	03	01	02	1.6	28
B	030	473-42	03	01	02	2.2	32
C	010	473-45	03	01	02	1.6	22
C	010	473-45	03	01	02	10.3	44
C	020	473-47	03	01	02	8.4	40
C	020	473-47	03	01	02	2.3	28
C	020	473-47	03	01	02	0.6	18
C	020	473-47	03	01	02	0.2	14
C	020	473-47	03	01	02	27.7	75
C	030	473-49	03	01	02	9.4	55
C	030	473-49	03	01	02	4.0	36
C	030	473-49	03	01	02	0.2	16
C	030	473-49	03	01	02	33.0	58
C	030	473-49	03	01	02	0.2	12
C	040	473-51	03	01	02	36.9	60
C	040	473-51	03	01	02	9.3	42

Rdtmn srf 473-57 03 01 02 0.2 14
Rdtmn srf 473-57 03 01 01 5.9 34
Rdtmn srf 473-57 03 01 02 15.0 46
Rdtmn srf 473-57 03 01 02 8.3 44
Rdtmn srf 473-57 03 01 02 11.3 42
Rdtmn srf 473-57 03 01 02 0.5 18
Rdtmn srf 473-57 03 01 02 1.0 18
Rdtmn srf 473-57 03 01 02 13.3 44
Rdtmn srf 473-57 03 01 02 15.8 42
Rdtmn srf 473-57 03 01 02 0.6 18
Rdtmn srf 473-57 03 01 03 13.3 50
Rdtmn srf 473-57 03 01 03 20.9 60
Rdtmn srf 473-57 03 01 03 22.3 52
Rdtmn srf 473-57 03 01 02 3.1 32
Rdtmn srf 473-57 03 01 03 19.5 48
Rdtmn srf 473-57 03 01 04 0.1 16
Rdtmn srf 473-57 03 02 14 11.2 00
Rdtmn srf 473-57 03 01 03 8.5 42

Bflt 020 1556 01 01 01 0.1 10
Bflt 020 1556 03 01 02 0.1 10
Bflt 020 1556 01 01 06 0.1 06
Bflt 020 1556 01 01 01 0.5 16
Bflt 020 1556 01 01 10 0.1 06
Bflt 020 1556 03 01 02 0.1 12
Bflt 020 1556 01 01 06 0.1 06

PRIMARY SORT FIELD: catalog
SELECTION CRITERIA: All records

UNIDENTIFIABLE DEBITAGE-RAW DATA

Key: Unt = Unit Ma = Material Type
Dep = Depth/Level Wht = Weight (gm)
Cat = Catalog # Gr = Grid/Size Range

CA-TEH-1554 B&B Rockshelter

unt	dep	cat	ma	wht	gr
A	020	455-5	03	0.4	16
A	020	455-5	03	10.7	52

A	020	455-5	03 0.3	18
A	020	455-5	03 0.5	14
A	020	455-5	03 16.5	50
A	020	455-5	03 4.1	28
A	020	455-9	03 0.1	10
A	030	455-10	03 1.2	22
A	030	455-10	03 18.7	60

CA-TEH-1555 Blue Dick Rockshelter

unt	dep	cat	ma	wht	gr
===	===	===	==	===	==
A	010	454-2	01	0.2	14
A	010	454-3	03	0.6	18
A	010	454-3	03	2.0	28
A	010	454-3	03	3.4	30
A	010	454-3	03	0.4	18
A	010	454-3	03	0.6	18
A	010	454-3	03	0.8	22
A	010	454-3	03	0.6	22
A	010	454-3	03	0.8	22
A	010	454-3	03	2.5	30
A	010	454-3	03	0.3	16
A	010	454-3	03	0.6	16
A	010	454-3	03	0.2	12
A	010	454-3	03	10.3	48
A	010	454-3	03	0.1	12
A	010	454-3	03	0.4	14
A	010	454-3	03	0.8	20
A	010	454-3	03	0.4	16
A	020	454-7	03	0.4	14
A	020	454-7	03	1.2	18
A	020	454-7	03	0.9	26
A	020	454-7	03	0.7	22
A	020	454-7	03	2.4	30
B	010	454-20	03	0.9	20
B	010	454-20	03	0.3	14
B	010	454-21	01	0.2	10
B	010	454-21	01	0.1	10
B	010	454-21	01	0.3	16
B	010	454-21	01	0.1	06

B	030	454-26	03 3.0	30
B	040	454-29	03 2.1	34
Aflt	030	1555	01 0.1	06
Aflt	030	1555	01 0.1	04
Aflt	030	1555	01 0.1	04
Aflt	030	1555	03 0.1	06

CA-TEH-1556 Pipevine Rockshelter

unt	dep	cat	ma	wht	gr
A	010	473-1	03	9.1	38
A	010	473-1	03	0.2	12
A	020	473-14	03	0.5	18
A	020	473-14	03	14.9	44
A	020	473-14	03	2.8	40
A	020	473-14	03	0.7	18
A	030	473-18	03	2.4	26
A	030	473-18	03	0.1	08
A	030	473-18	03	0.3	18
A	030	473-18	03	1.2	22
A	030	473-18	03	1.2	28
A	030	473-18	03	11.7	38
A	030	473-18	03	4.6	38
A	040	473-22	03	2.6	28
A	040	473-22	03	1.6	24
B	010	473-29	03	1.4	20
B	010	473-31	01	0.1	14
B	010	473-31	01	0.1	10
B	020	473-35	03	0.2	14
A	010	473-36	02	0.1	12
B	030	473-42	03	2.8	38
B	030	473-42	03	1.0	24

C 030 473-49 03 0.4 16

Rdmnd srf 473-57 03 0.4 14
Rdmnd srf 473-57 03 0.5 22
Rdmnd srf 473-57 03 1.5 28
Rdmnd srf 473-57 03 9.1 50
Rdmnd srf 473-57 03 0.4 18

Bflt 020 1556 03 0.1 06
Bflt 020 1556 03 0.1 12
Bflt 020 1556 03 0.1 08
Bflt 020 1556 01 0.1 06
Bflt 020 1556 01 0.1 06
Bflt 020 1556 03 0.1 06
Bflt 020 1556 03 0.1 06

PRIMARY SORT FIELD: catalog
SELECTION CRITERIA: All records

APPENDIX 7

California State University, Chico
Chico, California 95929-0400
Department of Anthropology
916.898-6192

August 27, 1992

Dr. Eric Ritter
Bureau of Land Management
355 Hemstead Drive
Redding, CA 96002

Dear Eric:

Enclosed with this letter you will find a table presenting the X-ray fluorescence (xrf) data generated from the analysis of ten obsidian artifacts from CA-TEH-1555 and CA-TEH-1556, Tehama County, California.

Trace element analysis was performed at the Department of Geology and Geophysics, University of California, Berkeley, using a Spectrace 440 (United Scientific Corporation) energy dispersive x-ray fluorescence spectrometer. The spectrometer is equipped with a Rh x-ray tube, a 50 kV x-ray generator and a Tracor x-ray (Spectrace) TX 6100 x-ray analyzer using an IBM PC based microprocessor and Tracor reduction software.

The x-ray tube was operated at 30kV, 0.20mA, using a .127mm Rh primary beam filter in an air path at 250 sec livetime to generate x-ray intensity data for elements rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), and niobium (Nb). Trace element intensities were converted to concentration estimates by employing a least-squares calibration line established for each element from the analysis of up to 26 international rock standards certified by the U.S. Bureau of Standards, the U.S. Geological Survey, Canadian Centre for Mineral and Energy Technology, and the Centre de Recharches Petrographiques et Geochimiques in France (Govindaraju 1989).

Trace element measurements on the xrf data table are expressed in quantitative units (i.e. parts per million [ppm] by weight), and matches between unknowns and known obsidian chemical groups were made on the basis of correspondences (at the 2-sigma level) in diagnostic trace element concentration values (in this case ppm values for Rb, Sr, Y, and Zr) that appear in Hughes (1986). As noted by Hughes (1986), the term "diagnostic" specifies those trace elements that are well-measured by x-ray fluorescence, and whose concentrations show low intra-source variability and marked variability across source. In other words, diagnostic elements are those whose concentrations values allow one to draw the clearest geochemical distinctions between sources.

The California State University

The artifact-to-source attributions for each specimen appear on the accompanying data table. As you can see, the majority (8 of 10) of the samples submitted conform to trace element profile of obsidian of the Tuscan trace element "signature". Although two samples (454-2 and 454-21) have trace element signatures unlike volcanic glass analyzed from this part of California, both of these samples show unusual enrichment in Sr and a corresponding depletion in Rb composition. Visually they appear to resemble the rhyolitic glasses that I have been encountering within the Inks and Paynes creeks areas in conjuction with my thesis work. The closest source counterpart in my inventory file at this time is with the Paynes Creek area, east of the town of Paynes Creek.

I hope this information will assist you in your analysis and interpretation of these site materials. Please contact me at my office [916-898-4360] if I can provide further assistance or information.

Sincerely,

Blossom Hamusek

REFERENCES

Hughes, Richard E.
1986 Diachronic Variability in Obsidian Procurement Patterns in Northeastern California and Southcentral Oregon. University of California Publications in Anthropology, Vol. 17.

Trace Element Concentrations

Specimen Number	Rb ppm	Sr ppm	Y ppm	Zr ppm	Nb ppm	Obsidian Source
RGM 1	145	104	24	223	6	
454-2	30 ±2	289 ±9	36 ±.6	147 ±8	10 ± 1	Unknown
454-21	44 ±2	300 ±9	38 ±.6	188 ±8	12 ± 1	Unknown
473-23	89 ±5	100 ±3	14 ± 2	73 ±4	5 ± 3	Tuscan
473-31A	87 ±5	83 ±3	14 ± 2	63 ±4	10 ± 3	Tuscan
473-24	82 ±5	92 ±3	16 ± 2	64 ±4	7 ± 3	Tuscan
473-31F	106 ±5	93 ±3	14 ± 2	68 ±4	7 ± 3	Tuscan
473-31E	84 ±5	92 ±3	14 ± 2	69 ±4	2 ± 3	Tuscan
473-11	93 ±5	99 ± 3	18 ± 2	70 ±4	10 ± 3	Tuscan
473-31C	96 ±5	89 ± 3	16 ± 2	60 ±4	7 ± 3	Tuscan
473-31B	83 ±5	81 ± 3	13 ± 2	66 ±4	8 ± 3	Tuscan

APPENDIX 8

California State University, Chico
Chico, California 95929-0400

Department of Anthropology
(916) 898-6192

March 30, 1992

Eric Ritter
Bureau of Land Management
Redding Resource Area
355 Hemsted Drive
Redding, CA 96002-0910

STATE UNIVERSITY, CHICO
100
1987-1987
ANNIVERSARY YEAR

Dear Eric,

This letter reports hydration band measurements from seven obsidian specimens obtained from CA-TEH-1556 and three obsidian specimens obtained from CA-TEH-1555, Tehama County, California. This hydration work was completed per your request on February 29, 1992.

The analysis was completed at the Obsidian Hydration Laboratory, an adjunct of the Lithic Research Center, Department of Anthropology at California State University, Chico. Procedures used by our hydration lab for thin section preparation and hydration band measurements are described below.

Two small parallel cuts were made at an appropriate location along the edge of the specimen with a 4 inch diameter circular saw blade mounted on a lapidary trimsaw. The cuts resulted in the isolation of a small sample with a thickness of approximately one millimeter. The sample was removed from the specimen and mounted with Lakeside Cement onto a permanently etched petrographic microslide.

The thickness of the sample was reduced by manual grinding with a slurry of #600 silicon carbide abrasive on a glass plate, thus eliminating any micro-chips created by the saw blade during the cutting process. The completed slides for CA-TEH-1556 are curated at our hydration lab under File No. 92-CS-1, and the completed slides for CA-TEH-1555 are curated at our hydration lab under File No. 92-CS-2.

The hydration band was measured with a strainfree 60X objective and an Olympus 10X filar micrometer eyepiece on an Olympus BH-2 petrographic microscope. Eight measurements were taken at several locations along both edges of the thin section. The mean of the eight measurements was calculated and is given on the enclosed data sheet.

If you have any questions regarding this hydration work, please do not hesitate to contact me. Thank you for your kind patience.

Sincerely,

Lisa Swillinger

Lisa Swillinger
Director, Obsidian Hydration Laboratory

OBSIDIAN HYDRATION CATALOGUE
PROJECT/SITE: CA-TEH-1556
CA-TEH-1555

SUBMITTED BY: BLM REDDING
PREPARED BY LITHIC RESEARCH CENTER, CSUC

ACCESSION DATA		PROVENIENCE		DESCRIPTION		HYDRATION(microns)	COMMENTS OBSIDIAN
Sample Number	Catalog Number	Unit	Depth(cm)	Name	Type	Mean	SOURCE
CS 92 1 1	473.11	Unit A	10	proj pt		1.7	
CS 92 1 2	473.31C	Unit B	10	flake		1.9	
CS 92 1 3	473.31A	Unit B	10	flake		1.9	
CS 92 1 4	473.31B	Unit B	10	flake		1.8	Tus(vis)
CS 92 1 5	473.37	Unit B	20	flake		1.8	Tus(vis)
CS 92 1 6	473.23	Unit A	20	flake		1.7	
CS 92 1 7	473-24	Unit A	40	flake	nodule	1.8	
CS 92 2 1	454-21	Unit B	10	flake		1.8	
CS 92 2 2	454-12B	Unit A	30	flake		1.7	Tus(vis)
CS 92 2 3	454-12B	Unit A	30	flake		1.7	

APPENDIX 9

Archaeological Investigations Northwest

1034 S.E. 122nd Ave. • Portland, Oregon 97233
FAX (503) 252-5405
Phone (503) 252-5140

December 31, 1991

Mr. Eric Ritter
U.S.D.I.-Bureau of Land Management
355 Hemsted Drive
Redding, CA 96002

Re: Blood residue analysis of 10 artifacts
from three north central California sites
AINW-RAL Letter Report #91/54

Dear Mr. Ritter,

At your request we conducted blood residue analysis of ten artifacts from four sites that you sent to our laboratory. The sites---CA-Teh-810 (Perry Riffle site), CA-Teh-1523 (Table Mountain Riffle #2 site), CA-Teh-1556 (Pipevine Rockshelter), and CA-Teh-1555 (Blue Dick Rockshelter)---are located in the Redding Resource Area in the Sacramento foothills of north central California. The submitted artifacts are primarily projectile points (all obsidian), but also include a basalt chopper-like tool (artifact No.473-53), a basalt chopper/scraper-like tool (473-7), a basalt unifacial discoid (473-40), and one broken mano (454-1).

We assigned numbers 1 through 10 to the artifacts for the blood residue analysis (see enclosed table of results). The artifacts appeared to have had some handling prior to shipment to our laboratory as all are very clean and have catalog numbers on them. Care was taken during the extraction of surface residues to obtain a sample from the tips and blades of the projectile points and from the working edge or surfaces of the larger basalt artifacts. Areas with catalog numbers were avoided.

An enclosure outlines the laboratory methods and procedures used for our analysis. Three of the basalt artifacts (specimens 7, 8, and 10) were too large to place in the ultrasonic cleaner, the normal procedure for extraction of the surface residues, and instead they were placed on a rotator with extraction fluid for 25 minutes. It was necessary to treat specimen number 9 in the same manner in order to get the extraction solution onto the working surface of the tool. All projectile points (specimens 1 through 6) were handled using normal procedures.

As requested, we tested the artifacts for evidence of human, avian, deer/elk, and rabbit blood residues. Chicken antiserum was used to test for avian residues. As indicated on the enclosed table of results, the surface residues extracted from specimen number 7, a chopper-like tool (artifact #473-53) from Pipevine Rockshelter, tested positive for avian. Because the initial test (gel #59) produced a faint reaction, this specimen was re-run (gel #74) and

once again produced a positive reaction. This shows that the artifact contains avian residues. We have found that chicken antiserum will react with chicken, pheasant, wild turkey, and mourning dove. Other researchers have found that it will also produce positive reactions with grouse and quail (Newman 1990).

The surface residues of the other nine artifacts all resulted in negative reactions to the four antisera used for the tests. This means that the artifacts did not retain residues from humans or those animals against which they were tested (i.e., avian species, deer, elk, and rabbit). However, they may contain residues from other animals. The negative reactions for human residues, despite indications that the artifacts had been handled prior to shipment to our laboratory, suggest that human residues will not be deposited on the artifacts during ordinary handling.

Sincerely,

John L. Fagan, Ph.D.

Enclosures

(31:M592)

COMPARATIVE RESULTS - SACRAMENTO FOOTHILLS SITES

BUREAU OF LAND MANAGEMENT

Type of Anti-serum	bear	bovine	camel	cat	** chicken	** deer	dog	elephant	goat	horse	** human	** rabbit	rat	sheep	swine	** NIS	** T N	
Specimen No.																		
(71-155) 1					-	-					-	-				-	-	
(71-450) 2					-	-					-	-				-	-	
(71-483) 3					-	-					-	-				-	-	
(72-158) 4					-	-					-	-				-	-	
(72-350) 5					-	-					-	-				-	-	
(473-11) 6					-	-					-	-				-	-	
(473-53) 7					+	-					-	-				-	-	
(473-7) 8					-	-					-	-				-	-	
(473-40) 9					-	-					-	-				-	-	
(454-1) 10					-	-					-	-				-	-	
GEL NO.					59	59					60	60				58	58	
GEL NO.					74	74												

ARCHAEOLOGICAL INVESTIGATIONS NORTHWEST
RESIDUE ANALYSIS LABORATORY

Laboratory Methods and Procedures

Blood residue analysis performed at Archaeological Investigations Northwest's (AINW) Residue Analysis Laboratory uses the technique of cross-over electrophoresis, a form of immunoelectrophoresis to analyze surface residues extracted from stone artifacts and other objects. Cross-over electrophoresis uses an agarose gel base with known antisera as reactants to identify the types of animals that left protein residues on the surface of tested artifacts.

Antisera are used as reactants in determining the identity of proteins extracted from artifacts, and are obtained from certified laboratories. An antiserum is made by injecting a laboratory animal, most commonly a goat or rabbit, with a protein from some other animal. The injected animal's immune system reacts with the foreign substance to produce a new substance, an antibody, that will react with the originally introduced antigen (protein). All vertebrates produce antibodies (immunoglobulins) as part of their immune systems. In solution these antibodies recognize specific foreign proteins (antigens), bind with them, and then precipitate out of solution. This antigen-antibody reaction and subsequent precipitation is a well known and useful property in medical and forensic research (Gaensslen 1983), and is the basis of cross-over electrophoresis.

Antigen-antibody reactions can be highly specific, although proteins from closely related species share enough of the same binding sites on the immunoglobulin molecule to react in similar ways. (Immunoglobulins are large Y-shaped proteins with binding sites located on the V portion of the Y.) Quantification of this type of reaction with sophisticated tests such as radioimmunoassay have been used to determine taxonomic relationships between living and extinct animals (for example, see Lowenstein [1980, 1985]), although that is outside the scope of cross-over electrophoresis.

In the AINW Residue Analysis Laboratory, residues to be tested are extracted from the surface of artifacts placed in a pre-washed tray. The extraction solution used is a 5% ammonia solution. This type of solution has been used for similar testing in forensic medicine (Kind and Cleevely 1969; Dorrill and Whitehead 1979), and generally shows better lifting power for proteins than either distilled water or saline solution, which can also be used. The extraction solution is pipetted underneath the artifact and the tray is floated in an ultrasonic cleaner for five minutes. The artifact and extraction solution are then placed on a rotator for five minutes. The extracted solution is then drawn off and stored in an airtight microcentrifuge tube. It is refrigerated if testing is to be done within a week, or frozen if testing is to be done a week or more later. Cross-over electrophoresis uses approximately five microliters (one-millionth of a liter) of the extracted surface residues per test, which is a great advantage in archaeological work where there is usually only a small amount of residual protein available for testing. Details of the extraction process, such as amount of solution used, extraction time, side tested, and type of solution used, are recorded for each artifact, along with data from the microscopic analysis if that step is performed.

To perform the electrophoresis, an agarose gel on gel bond (from Sigma Chemical Company and FMC Corporation, respectively) is prepared, which is a thin, flat sheet. Pairs of wells, or depressions, are punched out of the gel. Several liquid specimens extracted from the surface of the artifacts, plus positive and negative controls, are placed in the wells on each gel. Each pair of wells is a test for one artifact against one antiserum: one known antiserum is placed in a well opposite a well containing the solution extracted from the surface of the artifact. The paired specimens are situated on the gel bond in such a way that when placed in the electrophoresis, the extracted solutions to be tested are in wells oriented near the cathode and the antisera are in the wells near the anode. The agarose must have a high electroendosmosis rating.

Each gel is numbered and the specific antiserum and the extracted solution from each specific artifact are recorded on a laboratory form (Cross-over Electrophoresis Record) for each electrophoresis run. The results of each run, including the non-immune serum (NIS) and controls for each antiserum used, are also recorded on the laboratory record form for each group of artifacts analyzed. The Comparative Results form lists the artifact number, our assigned specimen number (if different than the submitted artifact number), our tracking number for the prepared gel, and the antisera used for the test. This form shows both the results of the analysis (negative and positive reactions) for the solutions extracted from the surfaces of the artifacts and the results of the non-immune serum tests.

Electrophoresis is done by placing the prepared gel between two troughs containing barbital buffer (obtained from Sigma Chemical Company). Cotton flannel wicks are placed in the liquid buffer and contact is made with each end of the sheet-like gel to form a complete circuit. Electrodes in each trough are connected to a power source for the electrophoresis operation. An electric current is applied across the gel (130 volts) for 40 minutes, and the high endosmosis of the agarose allows serum gamma globulins (IgG) in the antiserum (in the anodal well) to move towards the cathode while other proteins (albumin, and alpha and beta globulins) in the extracted solution (in the cathodal well) move towards the anode. When a positive reaction occurs, a protein precipitate forms between the two wells and may be visible as a white line or arc (Culliford 1971). This indicates a match between a known antiserum and unknown residue specimen, and occurs when the antigen in the specimen and antibodies in the antiserum bind and precipitate out of solution. Although this precipitate shows up as a white line between the two reactants, it may not be visible until stained with dye. After blotting and an overnight saline bath, the gel is dried and stained with Coomassie blue (a standard protein stain) to facilitate the viewing of positive reactions and as a permanent record of the cross-over electrophoresis results. The gel is archived at the AINW Laboratory.

A cross reaction (not to be confused with the cross-over electrophoresis reaction), or anomalous positive, sometimes occurs when an antibody recognizes the shape, rather than the chemical composition, of an antigen and partially reacts to it. Non-specific reactions to other proteins present in the extracted solution may occur as well. Therefore, in order to rule out false positives, extracted solutions from artifacts are run against a non-immune serum (derived from dried blood and not an antiserum) as part of a protocol to eliminate any cross reactions. If this step results in all negative reactions, then

the extracted solution from the surface of the artifact is assumed to provide valid results during the cross-over procedures with antisera. However, if a positive reaction to the non-immune serum occurs, then a second step is needed to confirm or negate the cross reaction. In this second step, a 1% solution of a non-ionic detergent (Tween 80, obtained from Sigma Chemical Corporation) is added to each extracted solution; the addition of the detergent solution leads to a stronger binding of antigen by breaking weak, non-specific bonds (for example, see Newman 1990). The extracted solutions from the artifacts' surface are then rerun against the non-immune serum and if all negative results are obtained, then the positive results of the following cross-over reactions with antisera can be accepted (Newman and Julig 1988). If, however, the reactions to the 'cleaned' non-immune serum are positive, then the positive reactions of any subsequent cross-over electrophoresis with antisera reactants are not accepted.

The electrophoresis unit of the Residue Analysis Laboratory at AINW uses a Heathkit regulated H.V. power supply (model #EIA-416, 120/240 VAC, 50-60 Hz, 150 watts) which supplies the constant 130 volts needed for the electrophoresis. An acrylic chamber for the electrophoresis has removable troughs for holding the buffer, and the electrodes built into the troughs are made of platinum wire to prevent electrons from the metal from entering the solution. The Residue Analysis Laboratory uses an electronic scale that meets specifications of 0.01 gram accuracy. Other equipment includes an Olympus binocular microscope (240X maximum magnification), an ultrasonic cleaner, and a rotomix rotator.

Forensic antisera are obtained from Organon Teknika Corporation, Sigma Chemical Company, and Nordic Immunological Laboratories. The type of antisera used has been solid phase absorbed to prevent cross reactions. As noted above, this type of antiserum will react not only with similar proteins from the target animal, but with proteins from closely related species as well. The forensic antisera used with this type of electrophoresis will give positive reactions at approximately the family level. For example, deer antiserum should react with blood proteins from other cervids such as moose or elk, but not with bovine proteins.

Although not performed for this particular analysis, artifacts may be examined under a binocular microscope to identify the location of residues. Although microscopic examination is not always desired or necessary, in many cases tissues, hair, and other residues may be identified through microscopic examination. In some cases, residues which were not visible under the microscope may be identified using cross-over electrophoresis. Nevertheless, microscopic examination can be used as a means of screening a collection to identify those artifacts with visible residues.

REFERENCES

Culliford, Bryan J.
1971 *The Examination and Typing of Bloodstains in the Crime Laboratory.* U.S. National Institution of Law Enforcement and Criminal Justice, U.S. Government Printing Office, Washington, D.C.

Dorrill, Marion, and P. H. Whitehead
1979 The Species Identification of Very Old Human Bloodstains. *Forensic Science International* 13:111-116.

Gaensslen, R. E.
1983 *Sourcebook in Forensic Serology, Immunology, and Biochemistry.* U. S. Department of Justice, U.S. Government Printing Office.

Kind, S. S., and Rosalyn Cleevely
1969 The Use on Ammoniacal Bloodstain Extracts in ABO Groupings. *Journal of Forensic Sciences* 9:131-139.

Lowenstein, Jerold M.
1980 Immunospecificity of Fossil Collagens. In *Biogeochemistry of Amino Acids*, edited by P.E. Hare, pp.41-51, John Wiley and Sons, New York.

1985 Molecular Approaches to the Identification of Species. *American Scientist* 73:541-547.

Newman, Margaret E.
1990 *The Hidden Evidence from Hidden Cave, Nevada: An Application of Immunological Techniques to the Analysis of Archaeological Materials.* Ph.D. thesis, University of Toronto, Toronto, Ontario.

Newman, Margaret E., and Patrick Julig
1988 Report on Blood Residue Analysis of Artifacts from the Cummins Site, Thunder Bay, Ontario. Paper presented at the Canadian Anthropological Association conference, Whistler, British Columbia.

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225

ER'S CARD 8805317

1999
xcavations on
, Tehama

	OFFICE	DATE RETURNED

(Continued on reverse)

E 78 .C15 R578 1999
Rockshelter excavations on
Hogback Ridge, Tehama